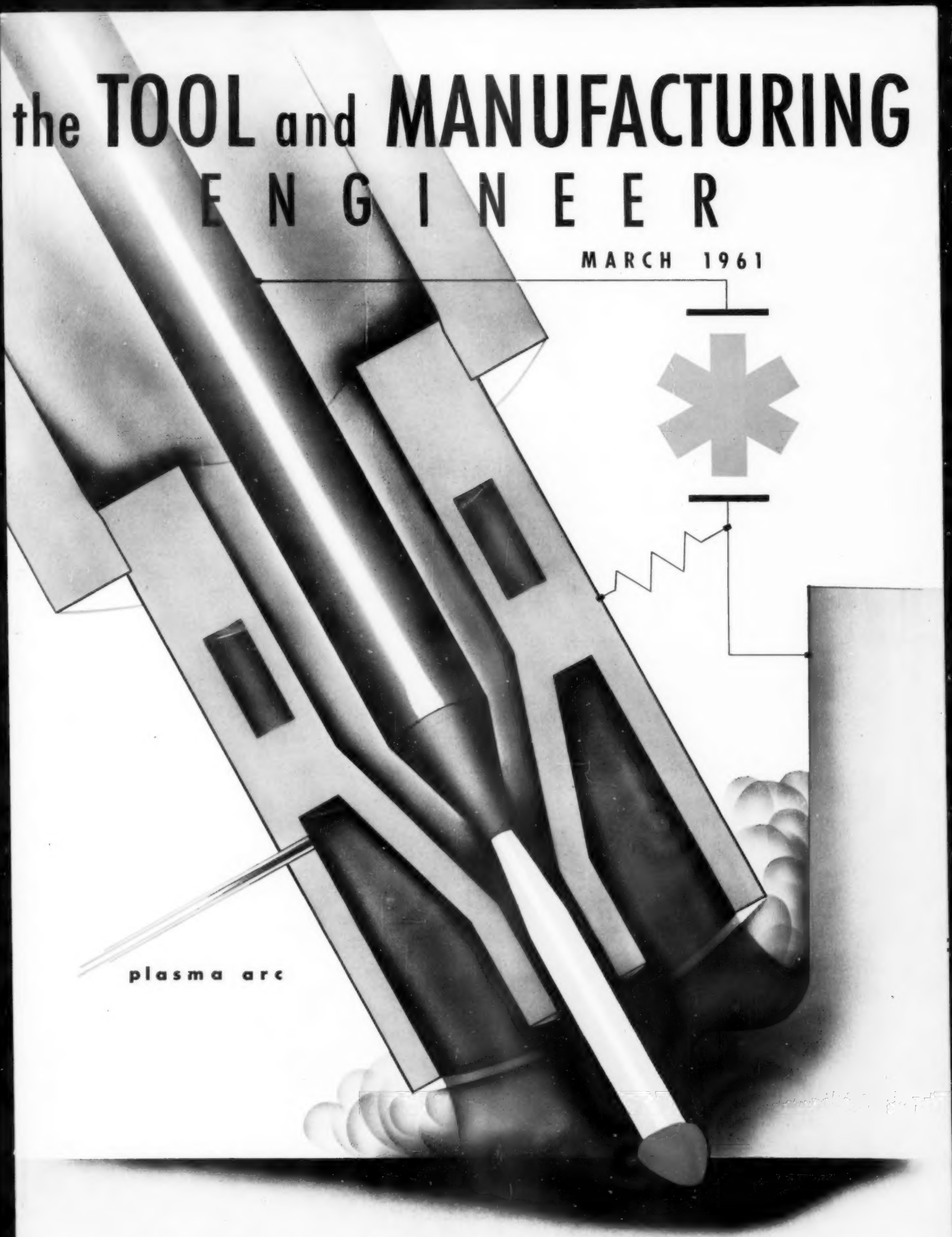
the TOOL and MANUFACTURING ENGINEER

MARCH 1961



plasma arc

AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS

TOOL-TIP GEOMETRY...

Elliptical or true Radius?

by Bruno A. Holmstrom
Chief Tool Engineer
The Heald Machine Company

To view this subject in its proper perspective, it is important to remember that no matter how large, complex or costly a boring or turning machine may be, it's the *tool tip* that does the work of removing metal. And on the proper geometry of this small but all-important part depends the success or failure of the entire machining operation.

One of the essentials of good tool design is the correct clearance angle between the work and tool at point of contact.

When finish cutting straight or tapered bores or O.D.'s, a varying clearance angle may be used, as all cutting is done with the outer tip of the tool where this angle is at the maximum. Here a conventional elliptical-point tool, where the clearance angle decreases on either side of the outer tip, is entirely satisfactory. Such tools can be accurately sharpened with an axis of tool reciprocation that is parallel to the face of the grinding wheel, as shown in Fig. 1.

However, when contour boring or turning spherical or irregular shapes, an entirely different situation occurs. Here, the point of contact on the tool tip varies from point to point on the workpiece, as shown in Fig. 2. If a conventional elliptical-point tool were used, the radius and clearance angle would vary from point to point on the work contour and optimum tool geometry would occur only at one of these locations.

For contour work, it is therefore preferable to use a true-radius tool tip—in which the clearance angle and radius is the same for any point on the cutting edge. To generate such a tip, the axis of tool reciprocation must be tilted with respect to the face of the grinding wheel, and this angle then becomes the constant clearance angle of the tool. This is shown in Fig. 3.

To permit grinding either *true-radius* or *elliptical-point* tools with maximum precision and economy, we developed the Heald Model 4 Tool Sharpening Machine. It is the *only* machine of its type which offers this choice of tool-tip geometry while providing fully automatic tool reciprocation for uniform and repetitive tool tip accuracy.

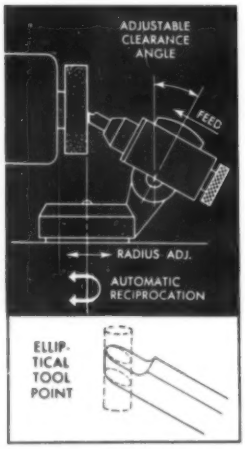


FIG. 1. Elliptical tool point with decreasing clearance angle for conventional straight-line work. Upper sketch shows arrangement of tool sharpening machine.

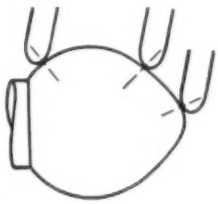


FIG. 2. Sketch showing how contact point of tool varies for different points on a contoured workpiece.

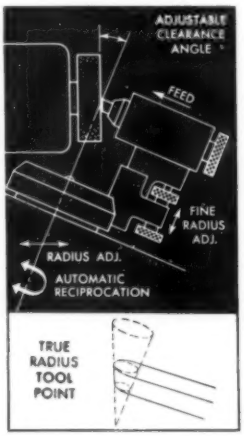


FIG. 3. True-radius tool point with constant clearance angle for contour boring or turning. Upper sketch shows tool sharpening arrangement.

FIG. 4. Heald Model 4 Tool Sharpening Machine arranged for precision grinding of true-radius tool point.

Ask your Heald representative for complete information on the Model 4 Tool Sharpening Machine, or send for Bulletin 2-4-3. **It PAYS to come to Heald.**

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WORCESTER 6, MASSACHUSETTS

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the TOOL and MANUFACTURING ENGINEER

Volume 46
No. 3

March
1961

THIS MONTH'S COVER

Because of their ability to develop high temperatures under controlled conditions, plasma arc torches are widely used for welding. In the torch shown on the cover, a stream of argon passes through an electric arc and is ionized. The stream of ionized gas passes through the nozzle to the work. Argon gas is also used to shield the jet of ionized gas. Uses of plasma arc torches are discussed in article on page 85.

THE TOOL AND MANUFACTURING ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index*, used generally in libraries. The magazine is available in microfilm form at moderate cost.

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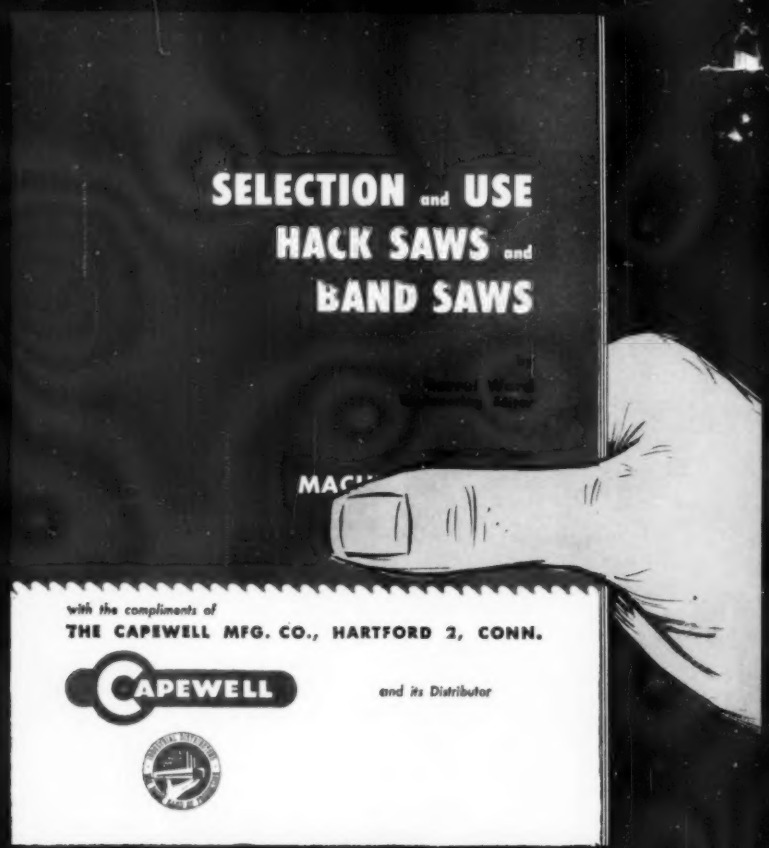

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Essential Teams of Economy

Cooperation of the scientist, engineer and engineering technician as an effective team is discussed in the lead article of this issue by O. S. Hulley, chairman of the ASTME education committee. Forming a highly organized group, this team is essential to efficient operation of industry.

Equally essential is another team composed of industrial management personnel, design and manufacturing engineers, and skilled labor. Although not as closely organized, their teamwork determines the success or failure for any industrial enterprise. Adequate communication, mutual understanding and common purpose are not always easy because of differences in viewpoints.

The welfare of our country and high standards of living are common goals of all. To achieve them, however, a healthful industrial environment must exist for these teams. This must necessarily be supplied by management and government, and includes capital and equipment. The contributions of engineering and labor are apparent. Each is dependent on the others for survival.

Success of the Atlas rocket is an illustration of teamwork between design and production. The Atlas record of 48 percent reliability seems shocking until placed in proper perspective.

Without engineering experience available, design has been virtually developed by scientists. Also, without the aid of experience records, manufacturing engineers developed manufacturing methods to produce the high degree of precision and accuracy required. Until designers refine the components and operational efficiency of missiles, the best talent and highest degree of manufacturing engineering will be required to improve reliability.

The almost countless number of components in the missile has been responsible for the low over-all reliability. Reliability of each component may be improved through design or by incorporating parallel systems at critical points. In the meantime the manufacturing engineer will of necessity improve his methods of production until satisfactory performance is achieved. He is content with nothing less.

John W Greve

EDITOR

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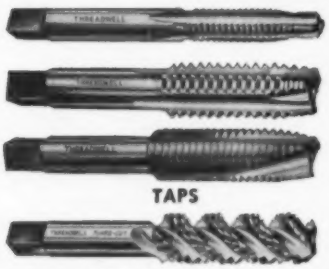
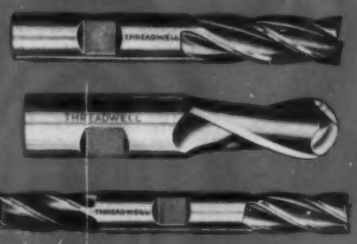


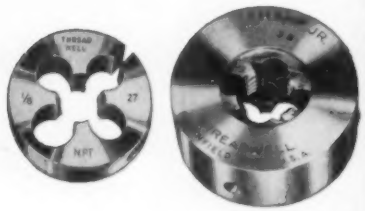
TAPS

TURBO-CUT TAPS



NEW END MILLS

COUNTERBORES



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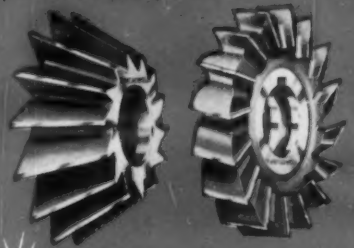
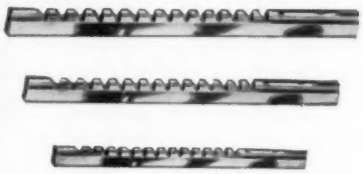


NEW MILLING CUTTERS



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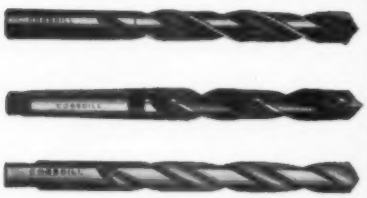

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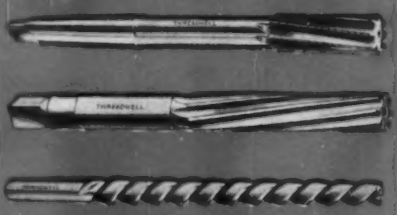
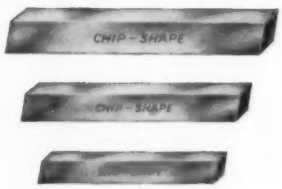


NEW REAMERS



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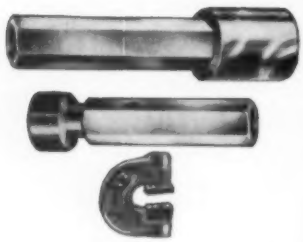

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preview

. . . a fast look at this issue

The Essential Triangle 63

As Chairman of the ASTME National Education Committee, O. S. Hulley has developed some provocative ideas on the scientist-engineer-engineering technician relationship.

He points out that the boundaries between the work of the scientist, the engineer and the engineering technician are not sharply defined. Briefly, the scientist is concerned with enlarging man's understanding of mathematics, physics, chemistry and the like.

The engineer uses the knowledge developed by the scientist in the design of products of all kinds—and in the design of production equipment and systems to manufacture those products.

The engineering technician plays an important role in helping the engineer translate his plans into reality.

These points are enlarged in the article.

Measuring Milling Forces 71

Because of the pulsating nature of milling forces, ordinary dynamometers do not give a true picture of what takes place during cutting.

A planetary gear torquemeter developed by engineers at Kearney & Trecker records milling forces with a high degree of precision. The results can be used to gain a better understanding of the milling process—an understanding that may result in improved milling techniques and equipment.

The torquemeter and its applications are described by K. & T.'s chief metalcutting research engineer, A. O. Schmidt, and several colleagues.

Automated Parts Storage 75

More efficient utilization of floor space and full mechanization are combined in a new parts storage system. The operator punches keys in a control panel to send parts to a desired location, then punches the same code to quickly retrieve the parts when they are required for assembly or shipment.

Optimum Metalcutting Efficiency 81

Optimum cutting speeds—the speeds that give the best combination of cutting speeds and tool life for lowest-cost production—can be quickly determined by applying basic formulas given in an article by Cincinnati Milling's Jens Wennberg. Running jobs at optimum speeds is not a complete solution to the problem of reducing metalcutting costs, Wennberg points out. The design of jigs and fixtures, downtime and the cost and benefits of automation all enter the picture.

Plasma Arc Jets 85

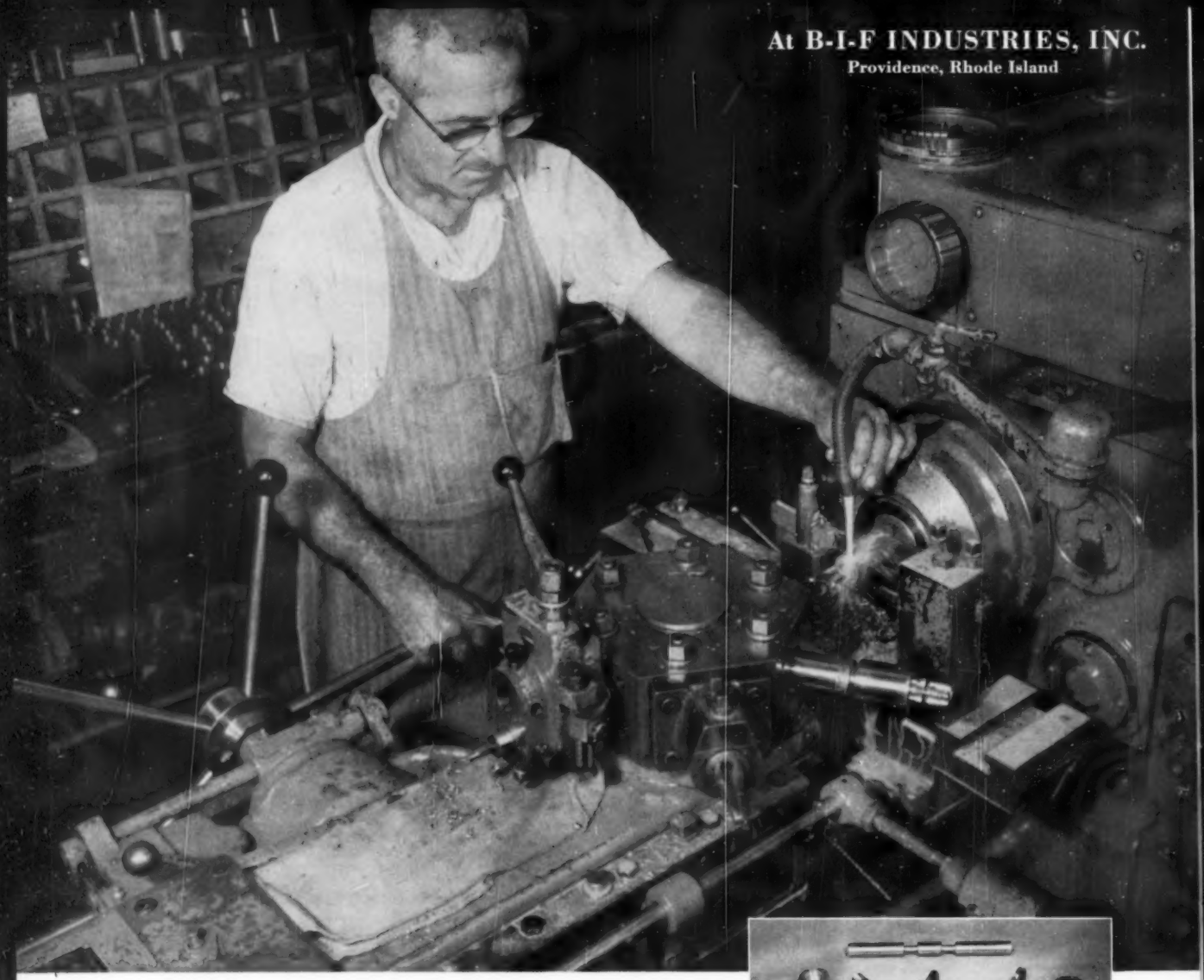
Temperatures in the 30,000 to 50,000 F range are attained by the stream of ionized gas—plasma—in a plasma arc torch. R. L. Hackman, laboratory division head of Linde Co., explains the principles of plasma jet cutting, welding and plating in his article and discusses actual production results.

Cutting Tool and Die Costs 95

Part 4 of a series of comprehensive articles by Carpenter Steel metallurgist J. S. Pendleton shows how intelligent selection of steels can cut the cost of tools. Pendleton includes some concise rules that simplify steel selection amazingly.

Turning with Throwaways 99

Increased lathe output can be realized by using throwaway carbide inserts—and by running those tools at high feeds and speeds. Lockheed manufacturing research engineers have developed feed and speed tables that enable optimum results to be achieved on a wide range of work materials. Chances are that the speeds given are faster than those you've been using.



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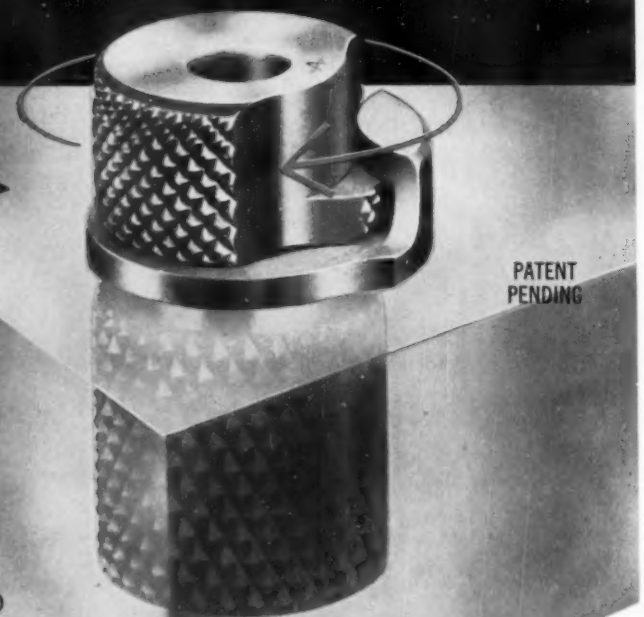

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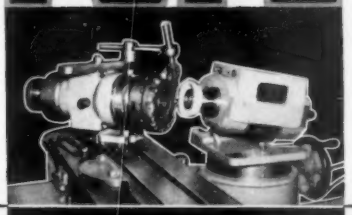
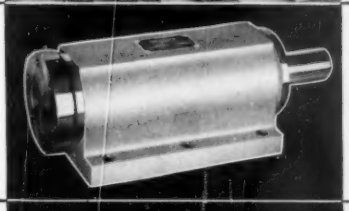


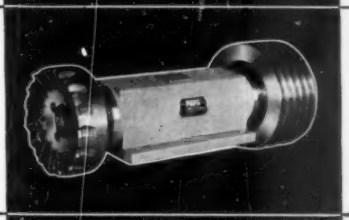
pictured is Pope P-6651-B Motorized Super-Precision Tilting Head for No. 2 Cincinnati Tool and Cutter Grinders. It is but one of hundreds of different Pope Grinding Spindles — motorized, belt driven, external, internal, deep hole, etc.

BORING



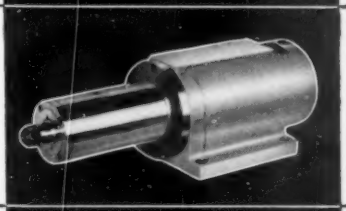
shown is Pope P-18501B Heavy Duty, Flange Nose, Belt Driven Precision Spindle for large deep hole boring and facing tools. Others include multi-spindle boring heads, motorized and motorized-belt driven high speed heads and super-precision heads for boring holes round.

MILLING



this Pope P-12007-M50 Heavy Duty, Belt Driven Spindle is available in sizes from 1 to 50 HP with standard No. 10, 20, 34, 40, 50 or 60 milling machine noses. (Ask for Bulletin S-17.) Other milling spindles include motor driven, gear hobbing, tracing attachment, right angle and offset types.

GRINDING MILLING DRILLING CUTTING



this Pope P-1029-AU Motorized, Heavy Duty Spindle is available from 900 to 3600 RPM and up to 20 HP. Shaft can be arranged to hold grinding wheels, milling cutters, drills or other cutting tools. Quick-change collet chucks are used for drilling, universal collet chucks for end milling.

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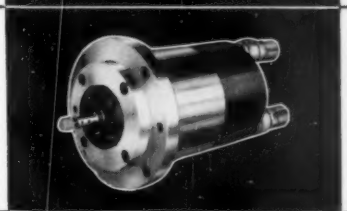

this Pope P-940 Motorized, Water Cooled, Oil Mist Lubricated, Grinding Spindle runs at 100,000 RPM, features *low maintenance cost*. Other heavy duty, high cycle Spindles at lower speeds are available for milling and other operations, and for mounting in a horizontal or vertical position.

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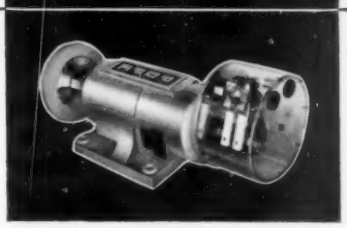

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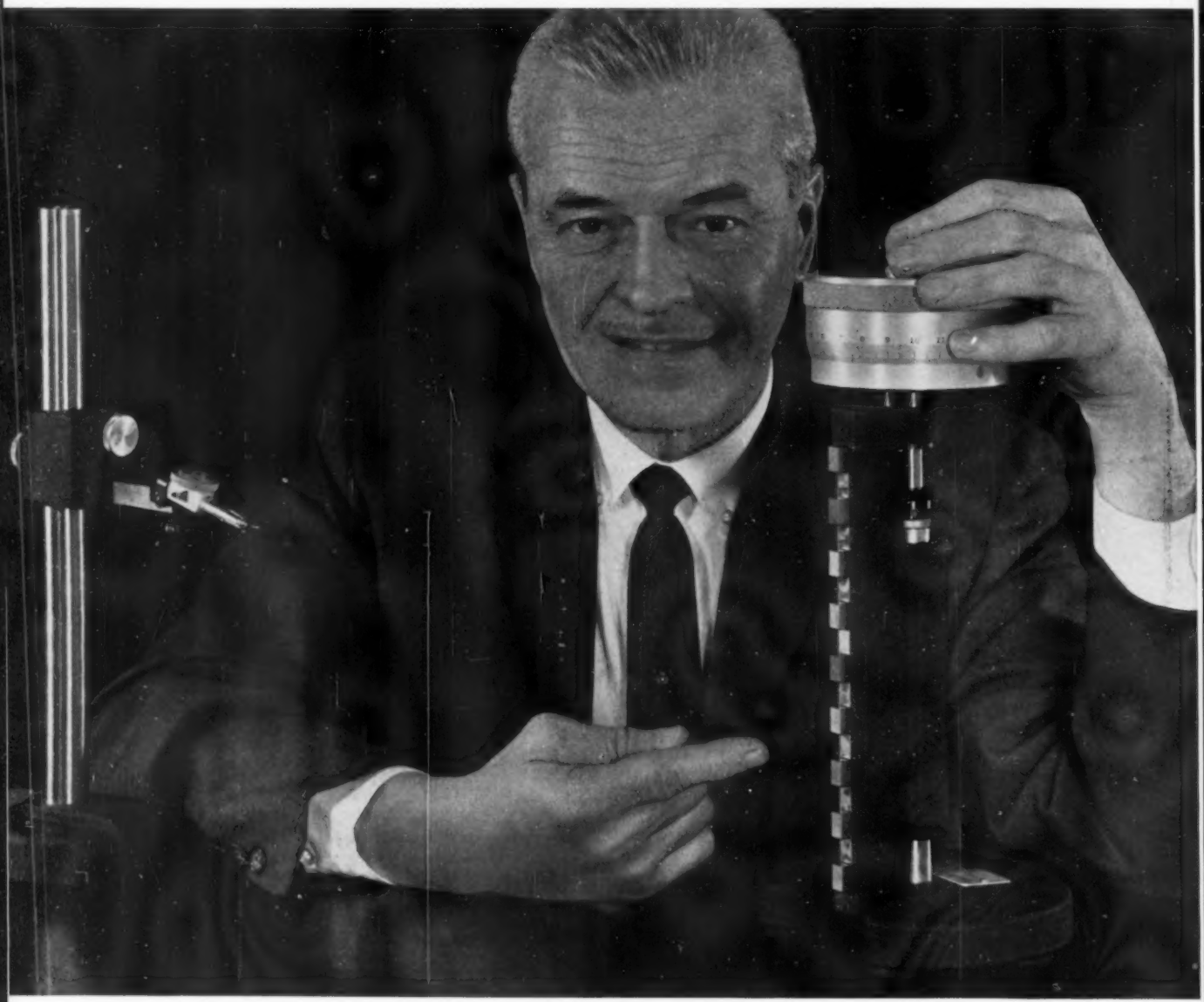

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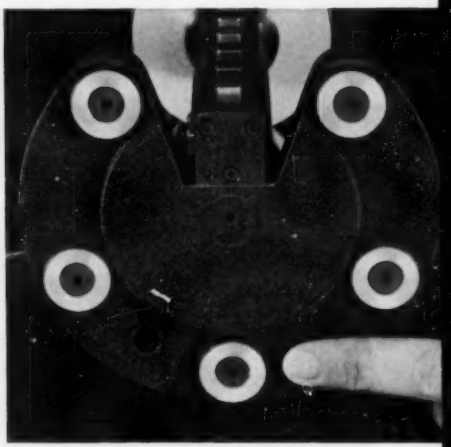
& Sharpe's new Hite-Set tool you can buy!"

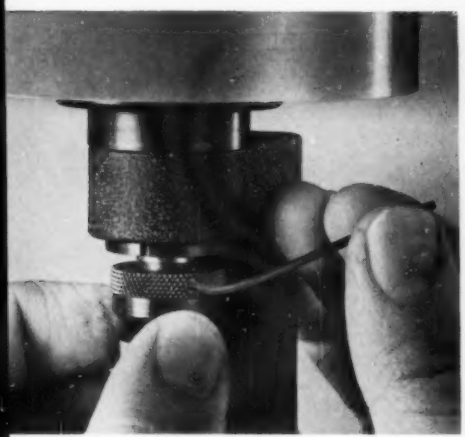
Design, Brown & Sharpe, Industrial Products Division

"Look at this easy-reading head! It's a full 4" across — the biggest in the business. Reads directly in tenths, and spreads the divisions out so you can see them all the way across a big surface plate or machine.

"See the accuracy you get — within .000050" over the entire range of blocks, and highly repeatable! You read off a small parallel surface, moving up and down, not, as in some tools, off a large rotating disk.

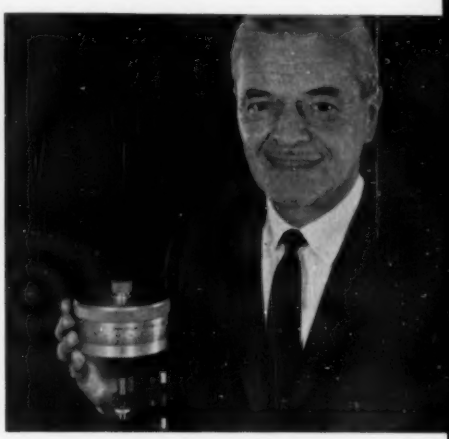


"Base is solid as a rock! These five big buttons are hardened and lapped to better than Class A Gage Block accuracy, so your Hite-Set won't tilt. (If it does, you need a new surface plate from Brown & Sharpe!)



"See the simple zero adjustment — You don't have to take the head off to set to "zero". Another feature: Repairs are economical; damaged Hite-Set blocks are replaced individually — you don't need a whole new column.

"Companion pieces to do any job better are available from Brown & Sharpe. Super Hite-Chek® (a) transfers heights in .000025". 9" Riser Blocks (b) extend range at low cost. B&S Black Granite plates and flats provide a perfect base.



"Finally, you pay less for Hite-Set accuracy. When the range of heights you want to measure is considered, you will find that combinations of Brown & Sharpe Hite-Sets and Riser Blocks usually cost less per inch of range than competitive tools."

Try Hite-Set, and you'll never settle for less! Ask your B&S distributor to show you this tool and the complete line of B&S inspection and gaging equipment. Brown & Sharpe Mfg. Company, Industrial Products Division, Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

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CONTROL VALVES

Whatever the application . . . whatever the service . . . whatever the pressure range . . . whatever the size . . . whatever the actuation required . . . chances are you'll find a valve in the Hunt line *exactly* suited to your needs.

Sizes range from ⅛ through 8 in. for vacuum to 300 psi air and for water, soluble oil and water, or oil to 5000 psi.

Your nearby Hunt representative will be pleased to work with you. You'll find him listed in Sweet's Product Design File.

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QUICK-AS-WINK® AIR AND HYDRAULIC

VALVES

HUNT VALVE COMPANY • DIVISION OF IBEC • SALEM, OHIO

For more information, write for Bulletin 603. Address Dept. TE-361, Hunt Valve Company, Salem, Ohio.

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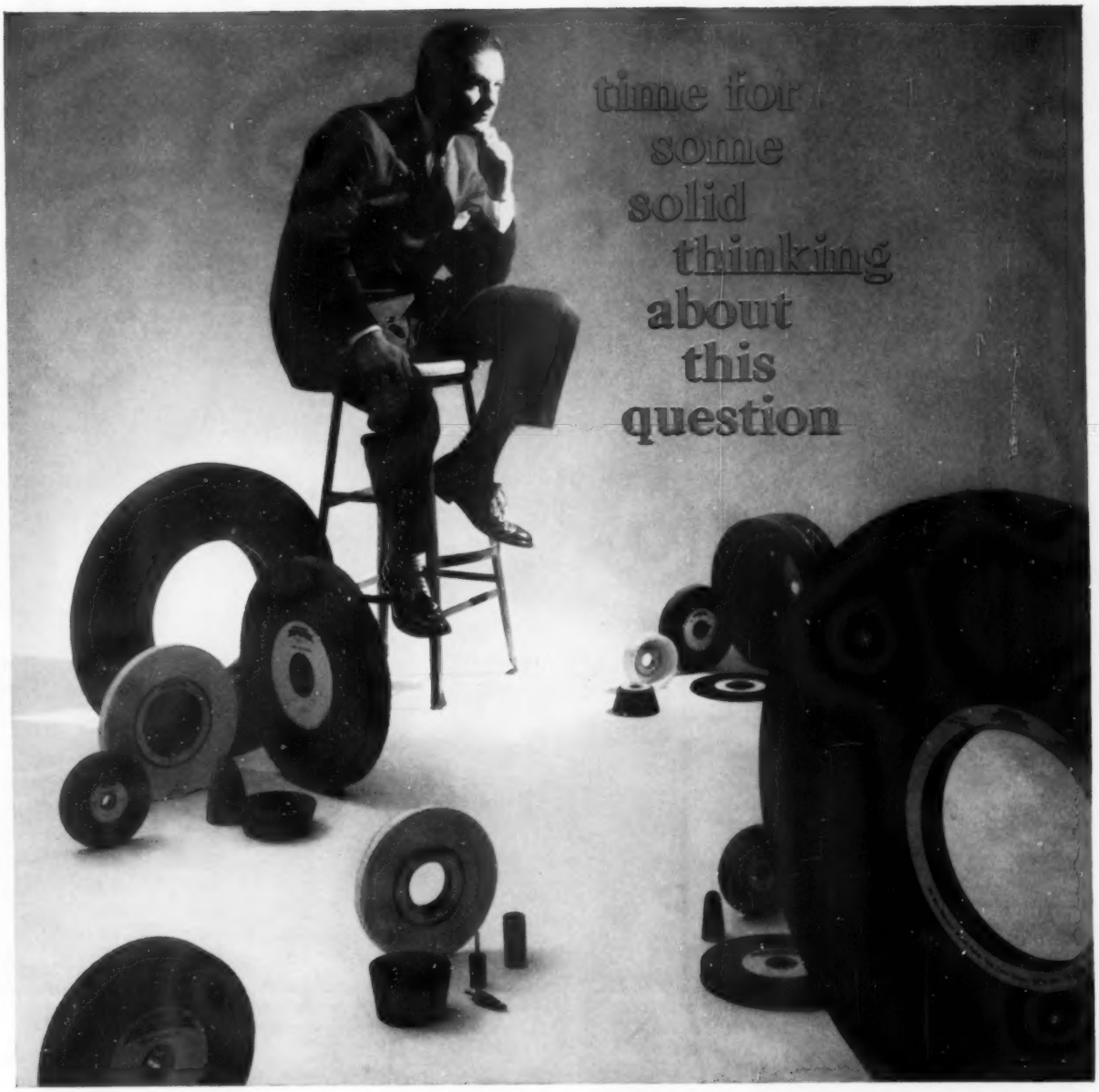

Are *you* getting the most profitable ratio between grinding costs and production? The key is efficient grinding wheel performance . . . and with Simonds Wheels you get it. Complete line has grinding wheels of every grain and grade combination . . . expertly-engineered products, thoroughly tested, readily available . . . and, in specifications now proving their cost-saving efficiency. New illustrated catalog provides complete information. Write for copy on your letterhead.

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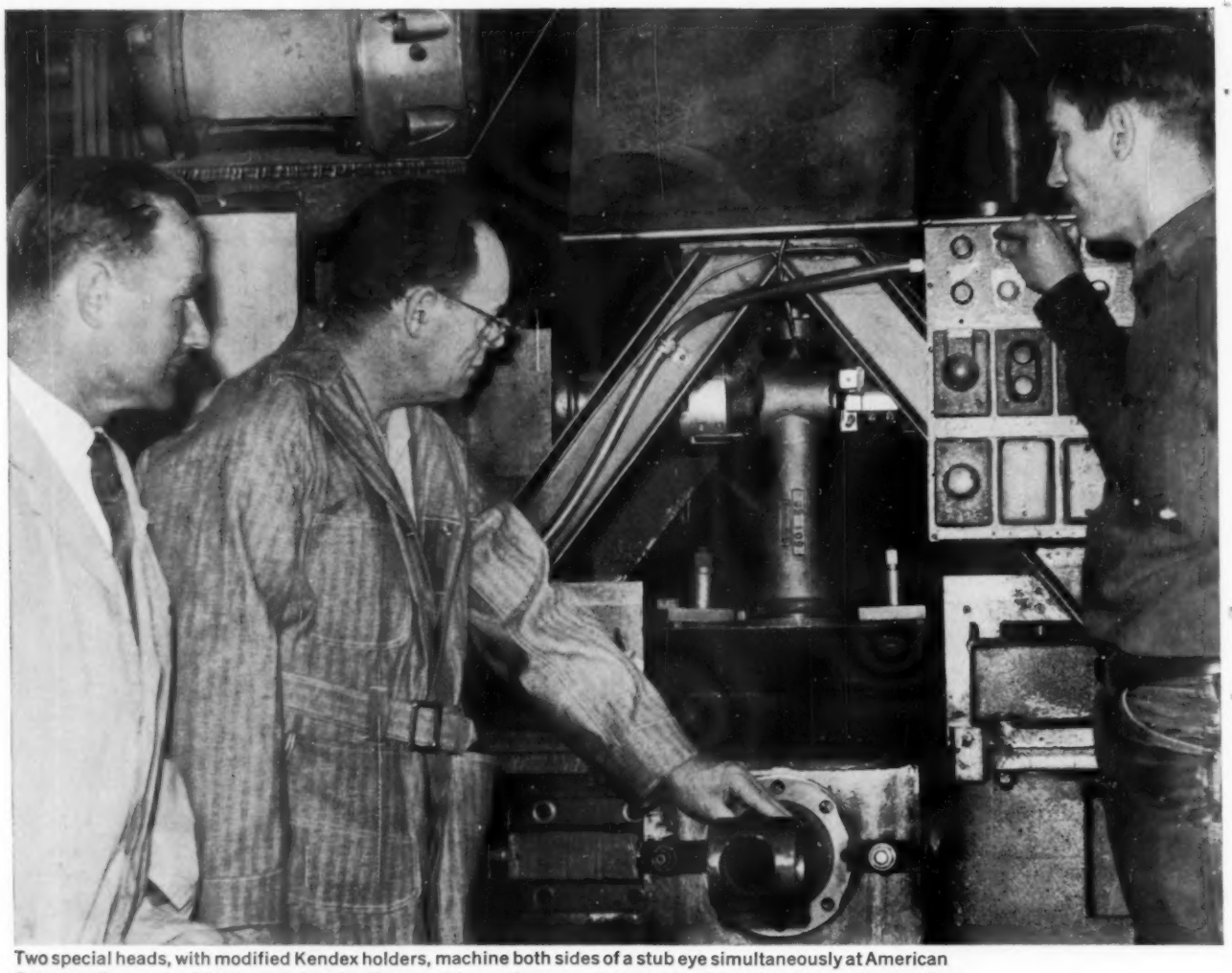
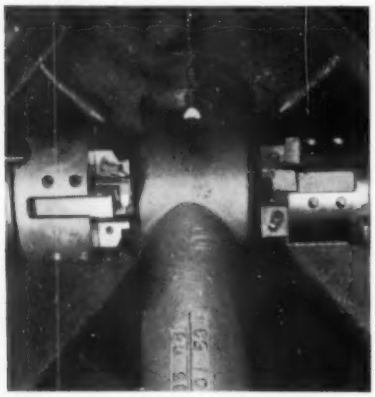
KENDEX* *tailored* TOOLING



Two special heads, with modified Kendex holders, machine both sides of a stub eye simultaneously at American Coleman Company, Littleton, Colorado. Range of bore sizes can be machined by simply resetting tools.

*Trademark



Developed in cooperation with customer's engineers, the two special Kendex boring heads—with Kendex "throwaway" inserts—have increased production, reduced cost per piece and improved the product.

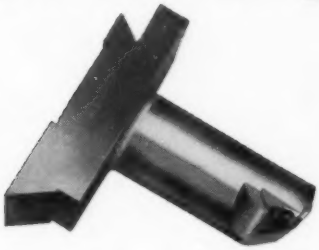
REASONS: Reduced initial set-up time from 3 hours to 30 minutes; eliminated the 5-hour tool regrinding job required after every 80 pieces. Instead of 3-hour set-ups, cutting edges are now indexed within ±.001 inch in 5 minutes. Saved—a full day's machine time for every 100 pieces.

Such IMAGINATIVE attacks on machining costs with Kendex Tailored Tooling are helping fight high costs in many plants. Applications shown at right may suggest operations in your plant where specially-designed Kendex tooling may combine two or more operations in one pass or help reduce machining costs in some other way.

Kennametal Carbide Engineers, trained to analyze tooling applications and backed by our headquarters staff of tooling specialists, are continually helping customers use standard tooling or design special tooling to reduce machine downtime and improve production. To meet the growing demand for Kendex Tailored Tooling, our production facilities have been expanded repeatedly within the last several years.

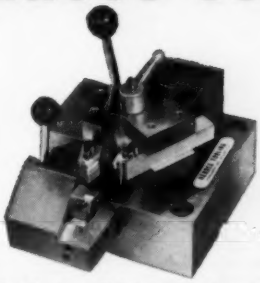
For full details about the Kendex Tailored Tools shown at right, plus many more, call your Kennametal Carbide Engineer. Ask him for our booklet "There's Profit in Retiring a Tradition" which gives dollars-and-cents facts as to how some companies have reduced machining costs as much as 70% with standard Kendex "throwaway" insert tooling . . . or write to KENNAMETAL INC., Latrobe, Pa. 33591

increases production...reduces cost

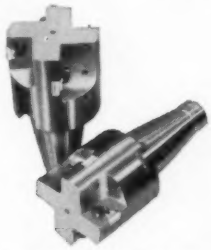


Boring Bar designed for mounting directly on machine tool turret in a gang tooling application. Dovetail mounting permits quick change of bore size.

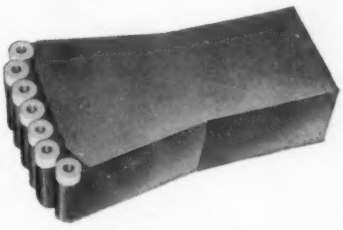
Special K-Bar used for machining transmission cover. Design utilizes threaded construction to allow removal of solid carbide bar from flange.



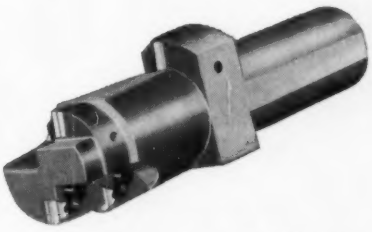
Special Facing, Skiving and Grooving Tool Block (rear slide) for machining transmission gear.



Special Milling Head for milling wrench slots (two flats for spanner wrench) on drill pipe.



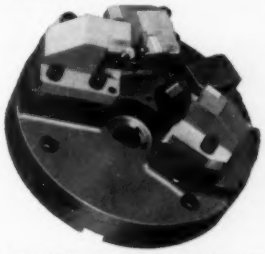
Multi-Screw-On Kendex for machining rough throws on large crankshaft.



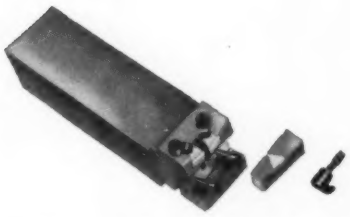
Special Multiple Insert Boring Bar with air coolant holes. Bores three diameters simultaneously.

K-Bar for tracing complex deep hole. High rigidity of Kennametal shank eliminates chatter.

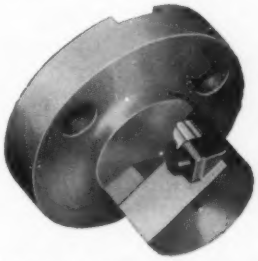
Special K-Bar with adjustable head for machining axle cross bores in differential carrier.



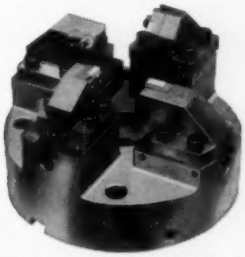
Special Hollow Milling Head for rough turning O.D. of bearing diameters, forming radius and chamfering of diesel tractor roller idlers.



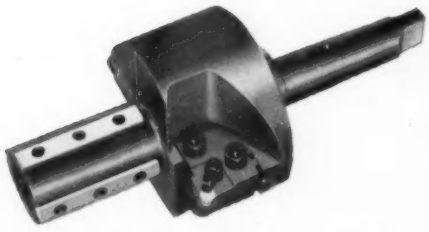
Multiple Insert Kendex Holder for facing and forming O.D. of oil slinger ring on crankshaft.



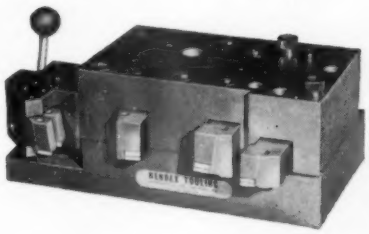
Special Kendex Holder for back facing gear plate of output shaft and planet carrier assembly through hole in gear blank.



Special Hollow Milling Head for finish turning O.D. of bearing diameters, forming radius and chamfering of diesel tractor roller idlers.



Boring Head for rough and finish boring of flywheel housing.



Rear Slide Tool Block for machining (finishing) gear transmission countershaft.

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Whether you operate O-M Cylinders, of the same psi rating, bore and stroke, singly or in sequence, each one will exert the same force, handle the same work load, with the same precision. In addition, the direction of each stroke, length of each stroke as well as the time interval between cycles will be controlled to the same high degree of accuracy. As all parts and mounts of O-M Cylinders, of the same capacity, are micro-honed or accurately machined to the same close tolerances, they are interchangeable and precise. Uniform operation is automatic.

O-M Cylinders are available in a complete range of sizes (1½" to 8" bores) with standard or heavy-duty rods. Complete line of interchangeable parts and mounts. Immediate delivery on most sizes.

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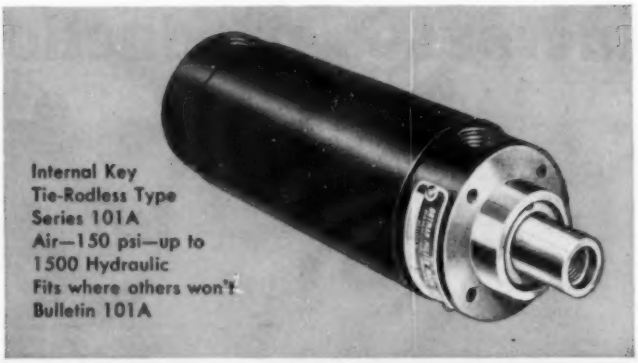

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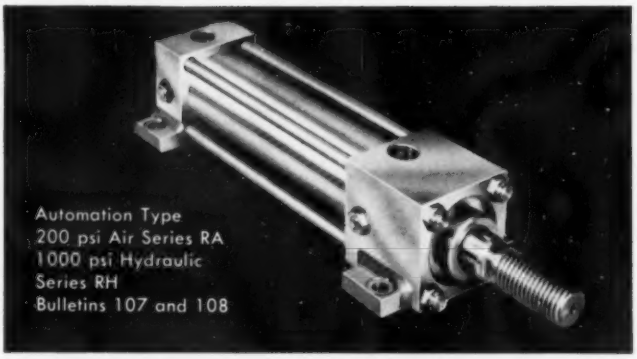
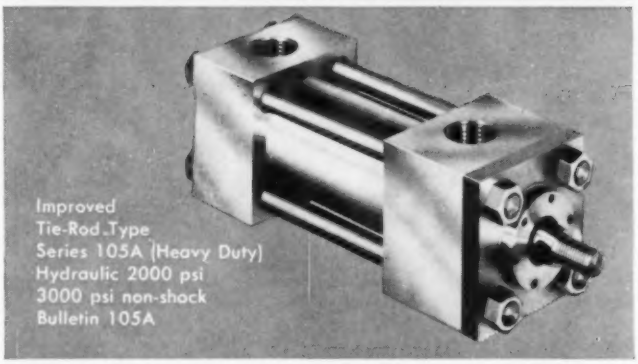
Air—150 psi—up to
1500 Hydraulic
Fits where others won't
Bulletin 101A



Automation Type
200 psi Air Series RA
1000 psi Hydraulic
Series RH
Bulletins 107 and 108



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Use Reader Service Card, CIRCLE 14


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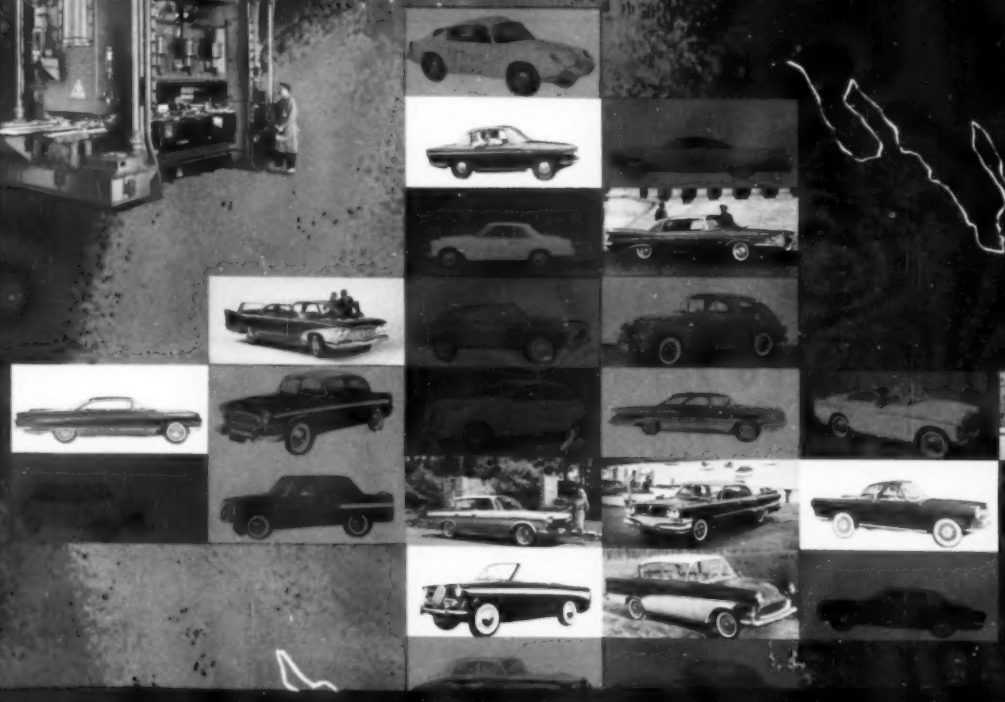

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ARING

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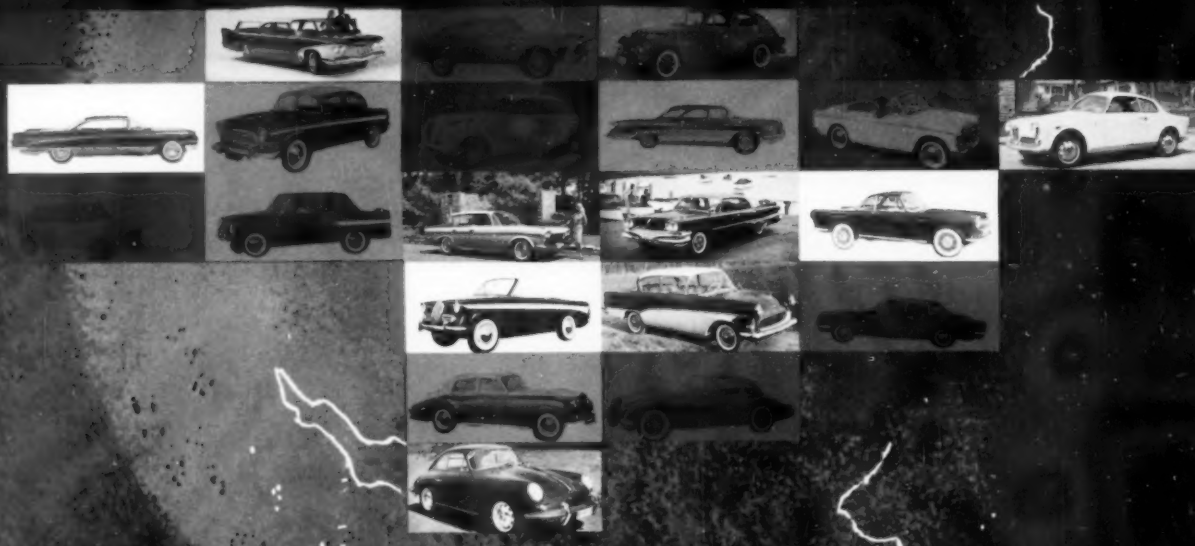
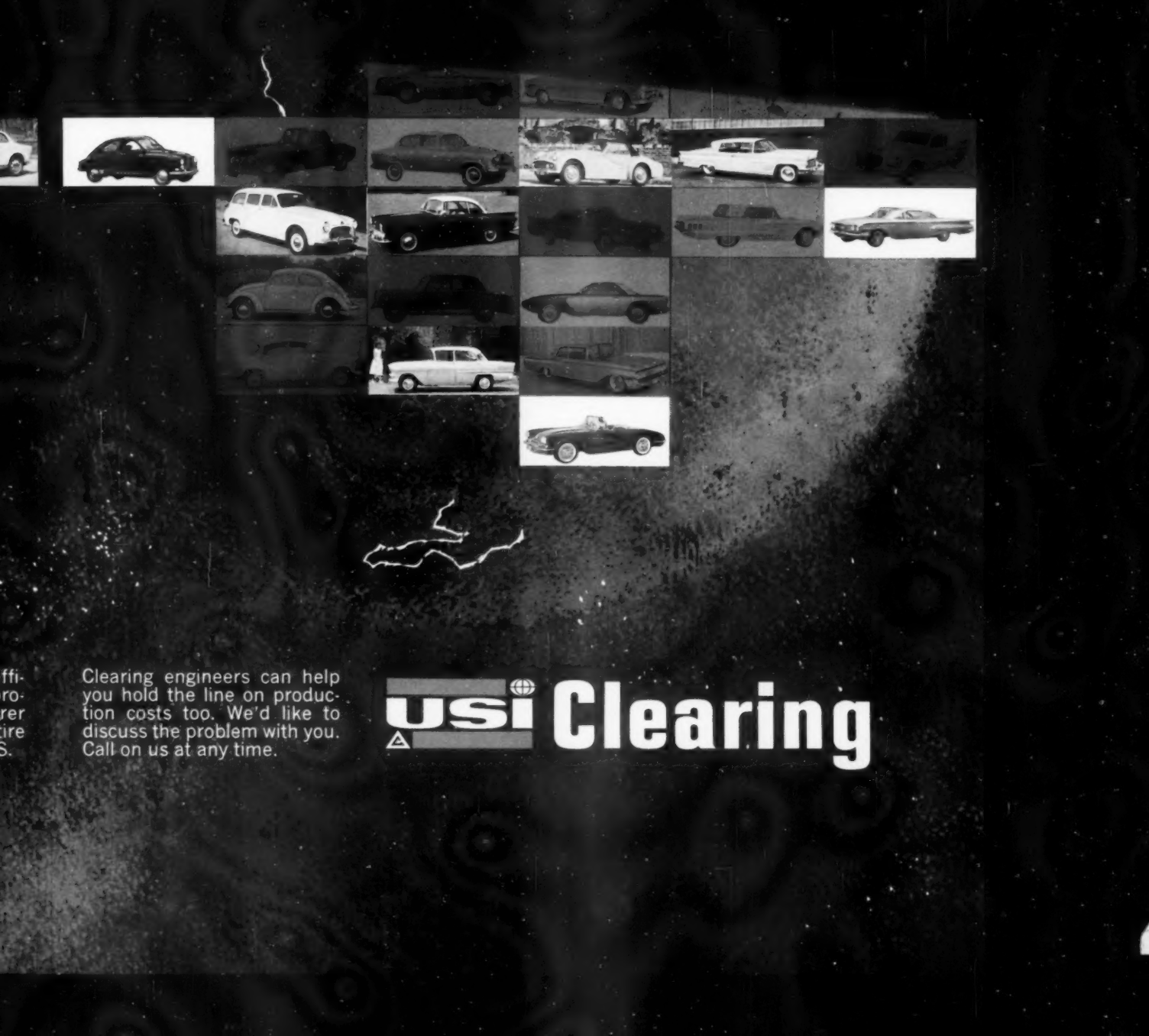
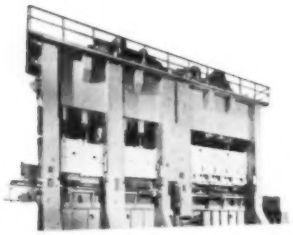


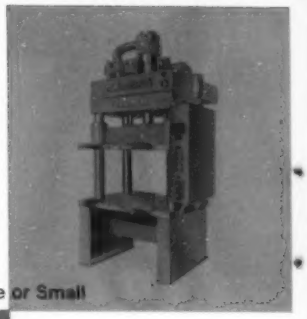
To help achieve the greatest efficiency, quality and economy in production, every major manufacturer of automotive vehicles in the entire world uses CLEARING PRESSES.



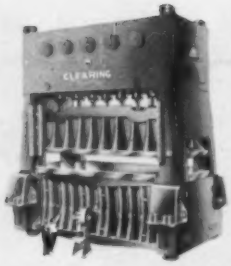
Clearing engineers can help you hold the line on production costs too. We'd like to discuss the problem with you. Call on us at any time.

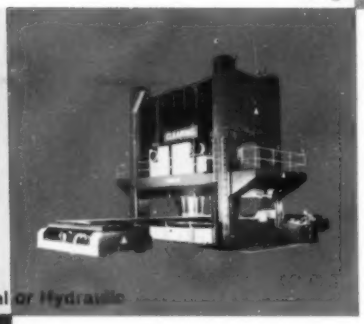
USI Clearing



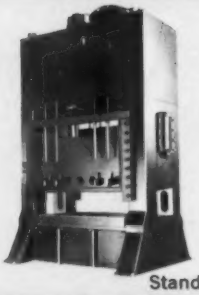


Large or Small

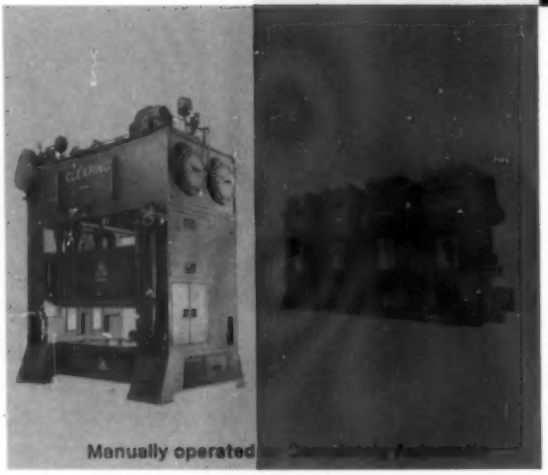




Mechanical or Hydraulic



Standard or Special



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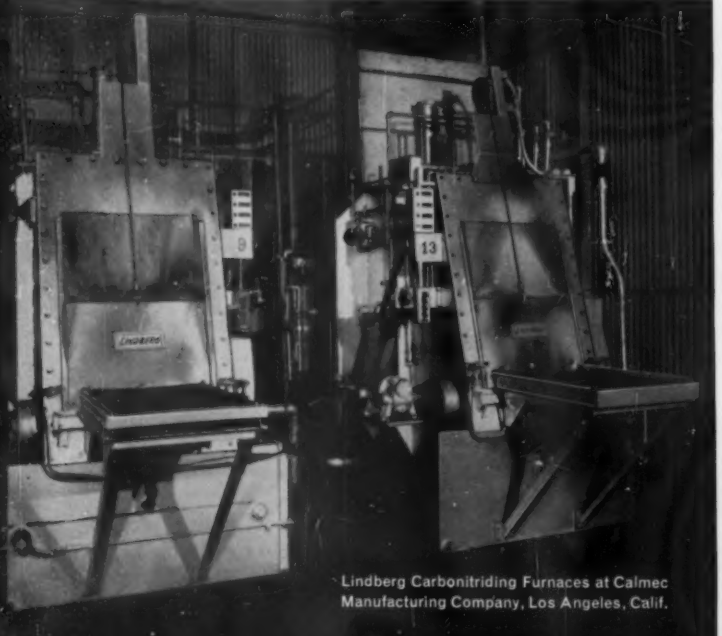
Use Reader Service Card, CIRCLE 18

J. F. McINTYRE tells why CALMEC always looks to Lindberg for heat treating equipment

Left, S. E. Summers, Chief Design Engineer and at right, J. F. McIntyre, Executive Vice-President, Calmec Manufacturing Company, Los Angeles. In the Middle, J. E. Krickl, Western Sales Manager, Lindberg Engineering Company.

"When we have heat treating problems we like to get the Lindberg man right in the middle of them. We know Lindberg men are heat treating experts and the best source we have for advice on the most practical and efficient equipment to satisfy any heat treating requirement. As a result we've bought lots of Lindberg equipment in the past few years. We like it and the fact that we are continuing to buy it proves that the Lindberg man's advice has been sound."



Lindberg Carbonitriding Furnaces at Calmec Manufacturing Company, Los Angeles, Calif.

Mr. McIntyre has certainly backed up the above words with deeds. Over the past few years, Calmec, a leading manufacturer of precision tools, parts and missile system components, has installed twelve electrically heated furnaces, six gas-fired furnaces and four atmosphere generators—all Lindberg! And we hope there are more to come. If you have any product or process in the metal or ceramic field requiring the application of heat it would be a good idea to get the Lindberg man in the middle right away. You can depend on his experienced help and Lindberg's engineering and design know-how to provide exactly the right equipment for your need. It's easy! Just get in touch with your Lindberg Field Engineer (see your classified phone book) or write us direct. Lindberg Engineering Company, 2447 West Hubbard Street, Chicago 12, Illinois.

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, South Africa, Spain, Switzerland and West Germany.

LINDBERG
heat for industry

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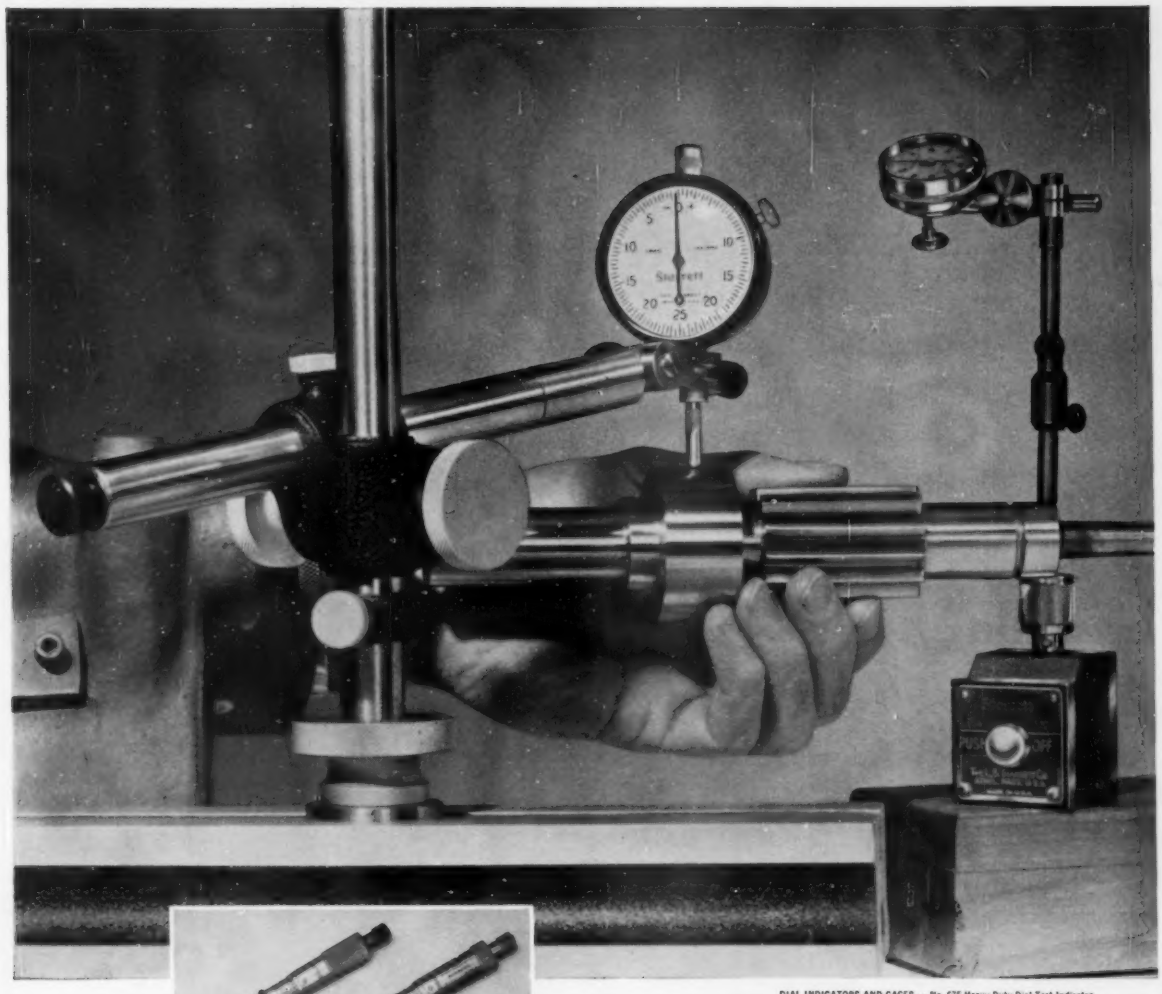
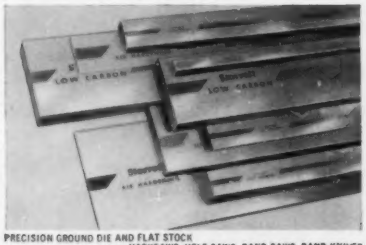


DIAL INDICATORS AND GAGES — No. 675 Heavy Duty Dial Test Indicator
No. 657C Magnetic Base Indicator Holder with No. 196B Indicator illustrated above

PRECISION MEASURING TOOLS



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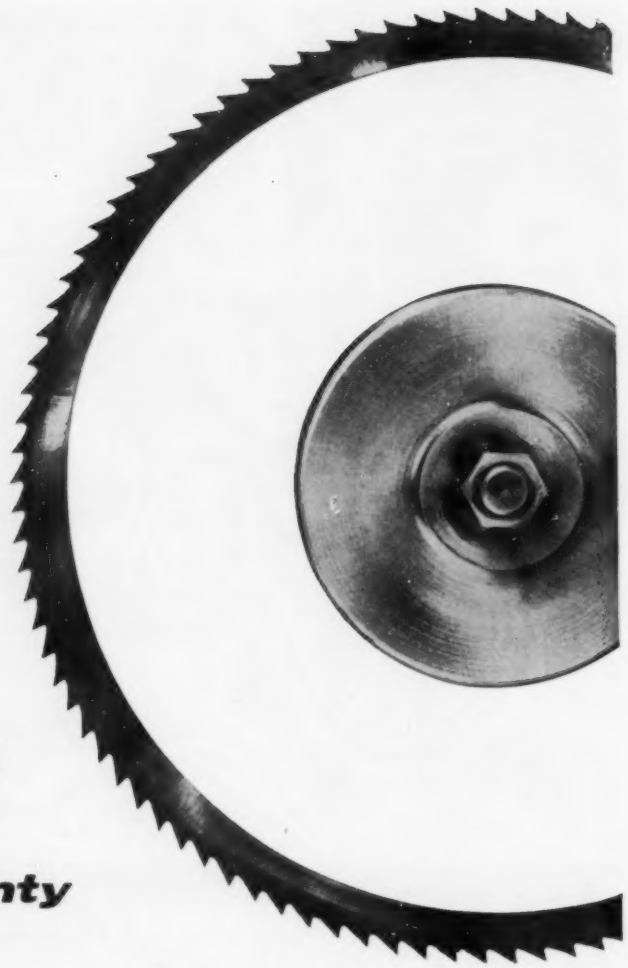
Starrett ingenuity gives skilled craftsmen every incentive to do the job right with the right tools for the job. In dial indicators and gages, there is a wide choice of types . . . each with unique features, all with the same high standard of accuracy and reliability.

The complete line of Starrett products is always readily available through your nearby Industrial Supply Distributor. Write for complete catalog No. 27. Address Dept. E, The L. S. Starrett Company, Athol, Massachusetts, U. S. A. . . .

World's Greatest Toolmakers



Every second a cutting tool stands idle while someone loads and unloads a fixture

...costs you plenty

A cutting tool makes money only when it's cutting. The seconds it stands idle while a finished part is removed and a fresh part fed to it are a total loss. That's why dial feeding parts with a Bellows Rotary Work Feeder—the fast automatic way to get parts to and from a machine—can cut machining cost by doubling, often tripling, machine output.

Bellows Rotary Work Feeders, and Index Tables, feed parts swiftly, accurately and safely to the tool—and take them away. All the operator has to do is load and unload while the machine keeps on cutting.

They are inexpensive to buy, inexpensive to install. Like to know more? Phone one of the 200 Bellows-Valvair Field Engineers, or write for Bulletins RT-1022 and RT-1326. Address Dept. TE-361, Bellows-Valvair, Akron 9, Ohio.

Bellows-Valvair

AKRON 9, OHIO

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

1001-C

BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

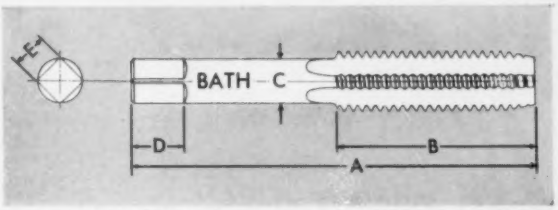
Vol. 1 No. 20

Subject: Making use of Standard Blanks for Special Taps:

Special taps can be furnished at a lower cost and delivered faster if your tapping application is such that standard tap blanks can be used in their manufacture instead of starting them from unhardened bar stock.

Taps made from standard blanks can be shipped in a matter of a day or two when delivery is an important factor in your threading requirements.

Bath maintains a large stock of standard blanks in a variety of flutes. These blanks are hardened, ground and ready for thread grinding. Some of the sizes carried in stock, for your convenience, are shown in the tables below.



TYPE	SIZE	A LENGTH OVERALL	B LENGTH OF THREAD	C SHANK DIAMETER	D LENGTH OF SQUARE	E WIDTH OF SQUARE
HAND TAP BLANK REGULAR LENGTH	¼	2½	1	.255	5/32	.191
	5/16	2 23/32	1⅛	.318	5/16	.238
	3/8	2 15/16	1¼	.381	3/8	.286
	7/16	3 5/32	1⅜	.323	13/32	.242
	½	3⅜	1 21/32	.367	7/16	.275
	9/16	3 13/32	1 21/32	.429	½	.322
	5/8	3 13/16	1 13/16	.480	5/16	.360
	11/16	4 1/32	1 13/16	.542	5/8	.406
	¾	4¼	2	.590	11/16	.442
	13/16	4 5/32	2	.652	11/16	.489
	⅞	4 11/16	2 5/32	.697	¾	.523
	15/16	4 23/32	2 5/32	.760	3/4	.570
	1	5⅛	2½	.800	13/16	.600
	1 1/16	5⅛	2½	.896	⅞	.672
	1⅛	5 5/16	2 5/16	.896	⅞	.672
	1 3/16	5 5/16	2 5/16	1.021	1	.766
	1¼	5¾	2 5/16	1.021	1	.766
	1 5/16	5¾	2 5/16	1.108	1 1/16	.831
	1⅜	6 1/16	3	1.108	1 1/16	.831
	1 7/16	6 1/16	3	1.233	1⅛	.925
	1½	6⅜	3	1.233	1⅛	.925
	1⅝	6 13/16	3 5/16	1.305	1⅛	.979
	1¾	7	3 5/16	1.430	1¼	1.072
	1⅞	7 5/16	3 5/16	1.519	1¼	1.139
	2	7⅝	3 5/16	1.644	1⅜	1.233
	2⅛	8	3 5/16	1.769	1⅜	1.327
	2¼	8¼	3 5/16	1.894	1 7/16	1.420
	2⅜	8½	4	2.019	1 7/16	1.514
	2½	8¾	4	2.100	1½	1.575
MACHINE SCREW TAP BLANKS	0	1⅜	5/16	.141	5/16	.110
	1	1 11/16	3/8	.141	5/16	.110
	2	1¾	7/16	.141	5/16	.110
	3	1 15/16	½	.141	5/16	.110
	4	1⅞	5/8	.141	5/16	.110
	5	1 15/16	5/8	.141	5/16	.110
	6	2	11/16	.141	5/16	.110
	8	2¼	¾	.168	¼	.131
	10	2⅜	⅞	.194	¼	.152
	12	2⅜	15/16	.220	5/32	.165
	14	2½	1	.255	5/32	.191
NUT TAP BLANKS	¼	5	1¼ & 1⅜	.185	5/16	.139
	5/16	5½	1⅜ & 1 13/16	.240	3/8	.180
	3/8	6	1½ & 2	.294	11/16	.220
	7/16	6½	1¾ & 2⅜	.345	¾	.259
	½	7	1⅞ & 2½	.400	⅞	.300
	9/16	7½	2 & 2¾	.450	⅞	.337
	5/8	8	2¼ & 3	.503	15/16	.377
	11/16	8½	2¼ & 3	.565	1	.424
	¾	9	2½ & 3¼	.616	1	.462
	13/16	9½	3¼	.679	1 1/16	.509
	⅞	10	2¾ & 3⅝	.727	1 1/16	.545
	15/16	10½	3⅝	.789	1⅛	.592
	1	11	3,3½ & 4	.834	1⅛	.625

TYPE	SIZE	A LENGTH OVERALL	B LENGTH OF THREAD	C SHANK DIAMETER	D LENGTH OF SQUARE	E WIDTH OF SQUARE
HAND TAP BLANKS SHORT LENGTH	1 1/16	4	1½	.896	⅞	.672
	1⅛	4	1½	.896	⅞	.672
	1 3/16	4	1½	1.021	1	.766
	1¼	4	1½	1.021	1	.766
	1 5/16	4	1½	1.108	1	.831
	1⅜	4	1½	1.108	1	.831
	1 7/16	4	1½	1.233	1	.925
	1½	4	1½	1.233	1	.925
	1⅝	5	2	1.305	1⅛	.979
	1¾	5	2	1.430	1¼	1.072
	1⅞	5	2	1.519	1¼	1.139
	2	5	2	1.644	1⅜	1.233
	2⅛	5¼	2	1.769	1⅜	1.327
	2¼	5¼	2	1.894	1 7/16	1.420
	2⅜	5¼	2	2.019	1 7/16	1.514
	2½	5¼	2	2.100	1⅛	1.575
PULLEY TAP BLANKS	¼	6,8	1	.255	5/16	.191
	5/16	6,8	1⅛	.318	3/8	.238
	3/8	6,8,10	1¼	.381	7/16	.286
	7/16	6,8,10	1 7/16	.444	½	.333
	½	6,8,10, 12	1 21/32	.507	9/16	.380
	5/8	6,8,10, 12	1 13/16	.633	11/16	.475
	3/4	10,12	2	.759	¾	.569
STRAIGHT TAPER TAP BLANKS	¼	12	1 & 1¼	.188	—	—
	5/16	12	1¼ & 1⅜	.240	—	—
	3/8	12	1⅜ & 1 5/16	.294	—	—
	7/16	12	1⅜ & 1 13/16	.345	—	—
	½	12	1⅜ & 1⅞	.400	—	—
	5/8	15	1⅞ & 2⅛	.450	—	—
	3/4	15	1 11/16 & 2 5/16	.503	—	—
STRAIGHT AND TAPER PIPE TAP BLANKS	1/16	2⅛	11/16	.3125	5/16	.234
	1/8	2⅛	¾	.3125	5/16	.234
	1/8	2⅛	¾	.4375	5/16	.328
	¼	2 5/16	1 5/16	.5625	7/16	.421
	3/8	2 5/16	1 5/16	.7000	½	.531
	½	3¼	1⅜	.6875	9/16	.515
	¾	3¼	1⅜	.9063	11/16	.679
	1	3¾	1¾	1.1250	13/16	.843
	1¼	4	1¾	1.3125	15/16	.984
	1½	4½	1¾	1.5000	1	1.125
	2	4½	1⅜	1.8750	1⅛	1.406

Whether your threading applications require standard taps or taps made from either standard blanks or unhardened bar stock, Bath can furnish properly designed tools for your specific tapping job that will result in the lowest cost per threaded hole. See your Bath distributor or write direct for further particulars.

• Cylindrical and Thread Gages • Ground Thread Taps • Internal Micrometers John BATH & Co., Inc.

28 Mann Street, Worcester, Mass.

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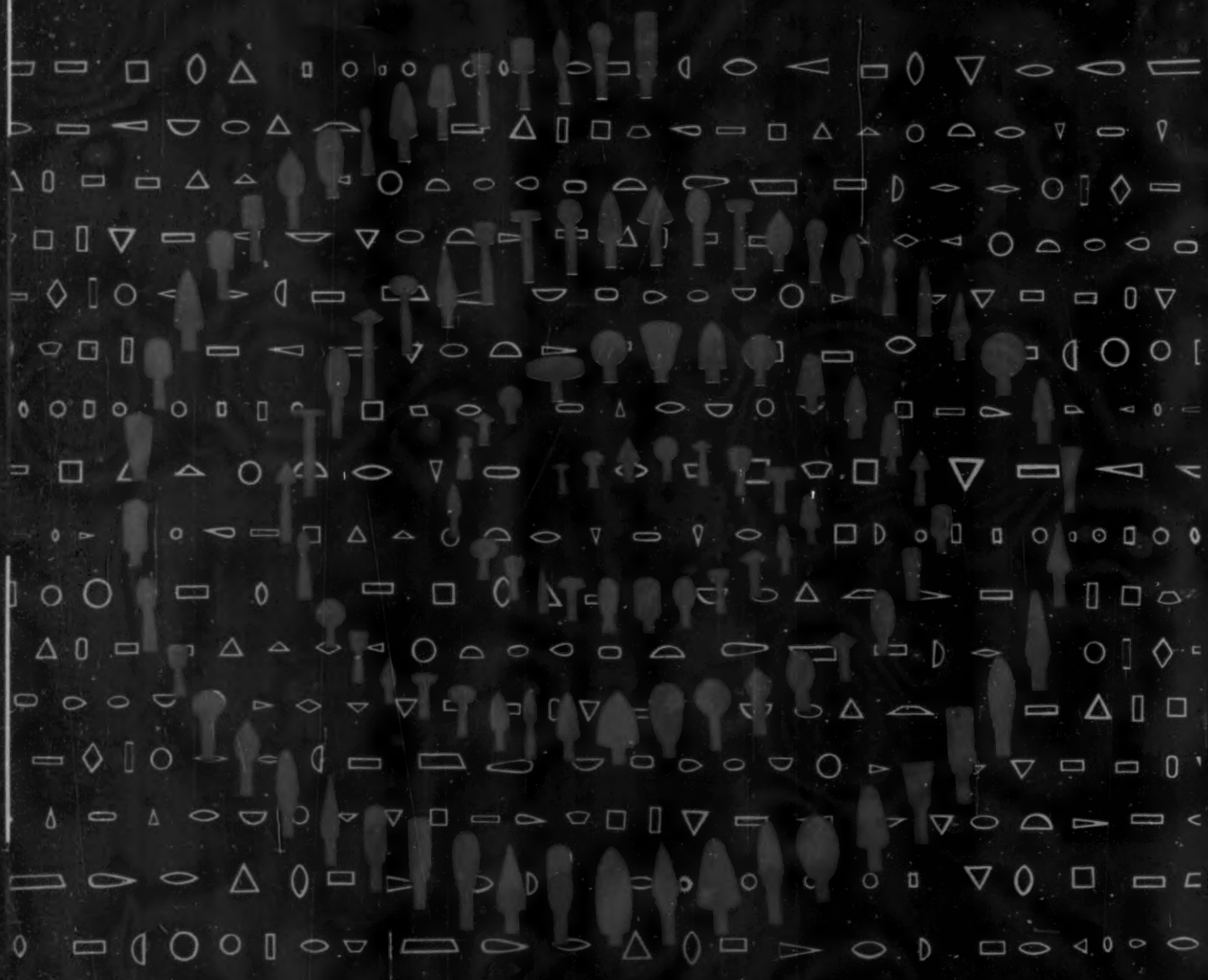

That's our line of Files—more than 4,000—in different shapes, sizes and cuts—Swiss Precision, American Pattern, Milled Curved Tooth, High Speed Steel Rotaries, chisel cut and ground from the solid, Tungsten Carbide Rotary Files or Countersinks—all famous for quality, accuracy and performance.

New FACET TOOTH* Tungsten Carbide rotary files—up to 25 times more efficent than ordinary T. C. rotary files.

New BI-DEX* Tungsten Carbide rotary files—eliminate "dead" areas for faster, better, more even metal removal.

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Atlanta: 1475 Spring St., N.W.—TRinity 6-1064 **New York:** 129 Lafayette St.—WOrth 6-0030

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ANNOUNCING THE NEW CARBOLOY® TRACER IN THE ADJUST-O-BREAKER TOOLHOLDER FAMILY

Now you can choose your tracer toolholders with all the cost-cutting advantages of the Carboloy® Adjust-O-Breaker line. The newest addition to the Adjust-O-Breaker line, this tracer toolholder is available in 2 styles and 7 sizes to help you handle more jobs with less tooling.

The exclusive Adjust-O-Breaker design lets you adjust the chipbreaker from any angle . . . offers any desired adjustment within its range . . . features "floating" indexable chipbreaker with absolute repeatability. In addition to the tracers, you can choose from negative rake Adjust-O-Breakers (10 styles, 54 sizes), and positive rake (5 styles, 50 sizes), to meet most of your tooling needs more efficiently and economically.

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With A-L's Tool Steel Steelector System

You Check Warehouse Availability Right At Your Own Desk

How often have you wished that you could bring the tool steel warehouse right to your desk so that you could see what grades and sizes and shapes are available immediately?

The new Allegheny Ludlum STEELECTOR Program does virtually just that. Special Data Stock Lists (18 of them) for each STEELECTOR Grade specify the complete necessary range of sizes and shapes available that will suit virtually all applications. They also list the working hardness of typical applications, temperatures for hardening, tempering, and annealing, plus other data.

You can count on the availability of STEELECTOR Grades. Mill depot and warehouse stocks have been selected and arranged to take the pressure off your own inventory. With the STEELECTOR Program you can select tool steels almost at a glance and be sure that the steel you have picked is in stock—ready for delivery—before you place your order.

Three STEELECTOR Cards make it easy to choose the proper steel for your application. The cards cover tool room, hot work, and high speed grades. The properties of the STEELECTOR Grades are shown by bar graphs for abrasion resistance, toughness, size stability, machinability, and red hardness. You can pick the grade with the particular combination of properties you need just by glancing at the graphs.

The colorful Tool Steel STEELECTOR Booklet gives complete details of the program, explains the Data Stock Lists, and includes the three STEELECTOR Cards. Ask your Allegheny Ludlum sales representative for your copy, or write: ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania. Address Dept. TE-3-2***

STEELECTOR PROGRAM

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country

1993

one chuck

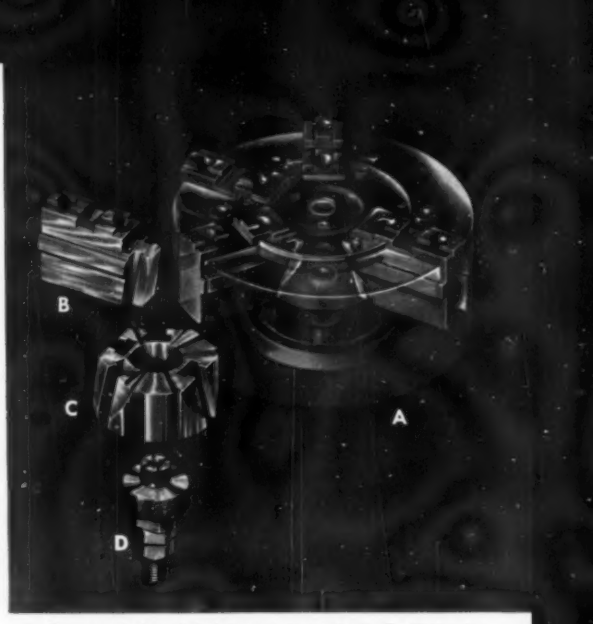
with

two or three jaws

SKINNER DUAL PURPOSE POWER CHUCK

One Dual Purpose Power Chuck saves the cost of an additional chuck

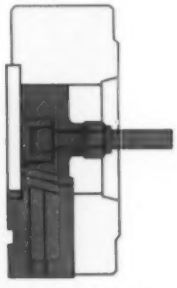
Skinner dual purpose standard power chuck is designed with four master jaws so that it may be used as a two or three jaw chuck. It is no longer necessary to pay for one chuck to machine round work, and an additional chuck to machine odd shapes and castings. Not only do you save the cost of an additional chuck but you get all of the advantages of Skinner power chuck design listed below. Skinner dual purpose power chucks are available with adjustable, non-adjustable, or serrated jaws, in sizes 8″ to 36″.



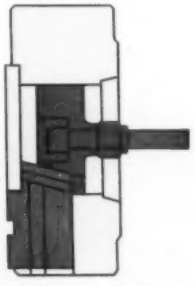
A—Transparent view of dual purpose power chuck B—Master Jaw
C—Wedge D—Drawbar Stud and Wedge plug

Skinner wedge-type chuck offers these advantages

- Allows automation of long production runs.
- Reduces operator fatigue—air performs the muscle work.
- Adjustable gripping pressure—air pressure can be adjusted for light or heavy chucking—is not left to the judgment of the machine operator.
- Work can be gripped internally or externally.
- Assured continued high accuracy because of wedge design (see illustration).
- Reduced wear because of hardened parts—models available with flame hardened center hole and jaw locks.
- Complete line—heavy and light duty models in sizes from 4″ through 36″.



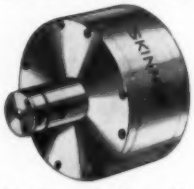
Wedge at top of stroke—
jaws fully open
(External gripping)



Wedge at bottom of stroke—
jaws fully closed
(External gripping)

The wedge and three jaws—only four moving parts—operate as a collet does with accuracy maintained over the whole range. The wedge angle is 14° which was found to be the most efficient angle for maximum power and jaw travel. With this wedge construction, the grip of a Skinner power chuck holds as set—even if the air line is broken—until opening power is applied in the opposite direction.

Skinner Power Chuck Accessories



Double-Acting Rotating Air Cylinders for use with power chucks and fixtures provide maximum pressure with a minimum amount of air. Cylinder walls are burnished to provide maximum sealing life. Cylinders in sizes 6 to 18 with semi-steel bodies are designed for low speed operation. Aluminum body cylinders in sizes 4 to 20 are designed for high speed operation.

Packaged Power Chucking Assemblies are available for Atlas, Cintilathe, Hardinge, Logan, Regal, Sheldon, South Bend, and many similar lathes. Assemblies are also available for Brown & Sharpe and similar automatic and hand screw machines to permit chucking of cold drawn parts, small or odd shapes and castings. Packaged assemblies consist of chuck with two or three jaws, threaded drawbar or drawtube, rotating air cylinder, cylinder adapter and necessary mounting for the individual machine.

Power Chuck Fixture, air or hydraulically operated, holds work for drilling and milling machines and for other bench and machine installations. Available in many jaw types in sizes 5″ to 36″.

A Complete Line of power chucking accessories includes hand, foot, and solenoid valves, drawbars, air units, and soft blank top jaws.

• • • •

For complete information about the Dual Purpose and other power chucks and power chuck equipment, contact your Skinner Representative, Distributor, or write us at the address below.

SKINNER CHUCKS

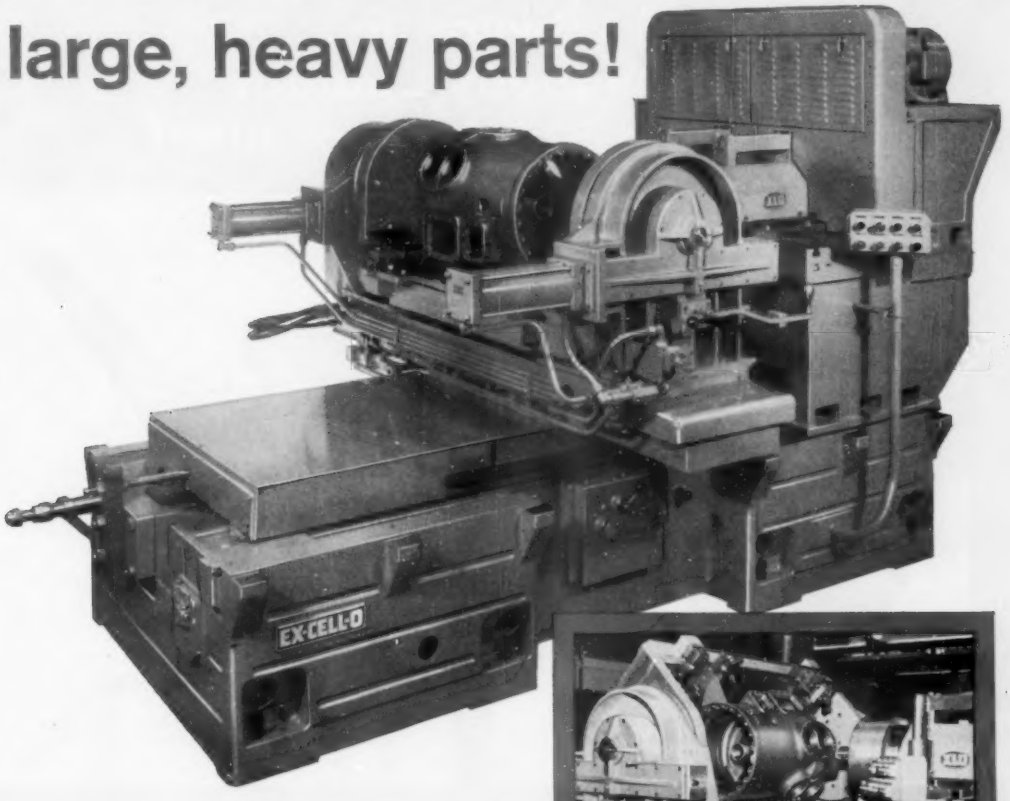
THE CREST OF QUALITY

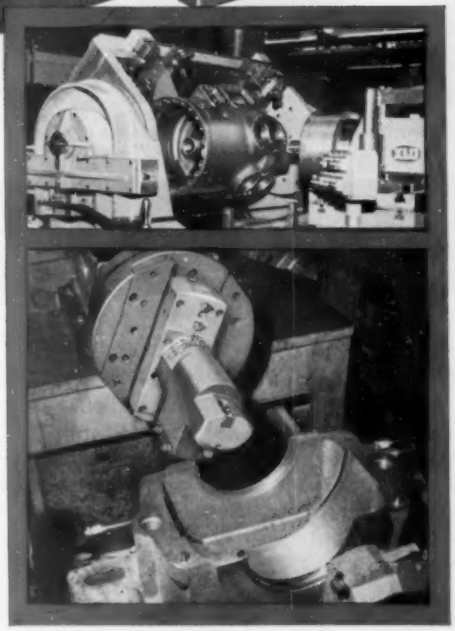
SKINNERCHUCKS

SKINNER-HORTON CHUCK DIVISION
SKINNER PRECISION INDUSTRIES, INC. • NEW BRITAIN, CONNECTICUT, U.S.A.

PRINTED IN U.S.A.

STANDARD EX-CELL-Os
for large, heavy parts!





- Accuracy, heavy cuts and good finishes on large parts are the high-production features of Ex-Cell-O Models 771 and 772 (double-end) Horizontal Precision Boring Machines
- These precision-built workhorses have husky nickel cast-iron bases with wide-spaced ways, extra-strong tables to handle the heaviest fixtures and workpieces, and infinitely adjustable hydraulic feeds in both directions for maximum cycling efficiency.
- A range of standard spindles, bridges and drive equipment lets you custom-equip Models 771 and 772 to suit your particular precision boring, turning, facing, grooving and chamfering operations.

Contact your Ex-Cell-O Representative or write direct for details.

Typical of parts handled by Models 771 and 772 are large air conditioning compressor housing castings (main illustration and close-up above), and cast-iron pillow block bearing support housings (bottom photo). Machine takes ⅝" cut as it roughs, finish-bores, and generates interior form of support housing in a single cycle.

60-25

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

WHY BUY METAL YOU DON'T USE?

Switch to Allegheny Ludlum Cast-to-Shape Tool Steel

FORGING

Stepped-out forging for fabricating spinning cone: 2300 lbs.—$2691 material cost plus cost of machining.

CAST-TO-SHAPE

Cast-to-shape spinning cone 1059 lbs. $860.97 Includes cost of the pattern.

$1,831 Saved by changing to Cast-to-Shape

Why pay for metal that ends up as chips on your floor? Here are two fine reasons for switching to Allegheny Ludlum cast-to-shape tool steels.

CAST-TO-SHAPE MEANS YOU BUY FEWER POUNDS OF METAL.
Because the tool you buy is closer to its finished shape, you obviously spend less money on original metal. In the above example, the savings in metal cost alone amount to $1,894.

CAST-TO-SHAPE MEANS LESS FINISH MACHINING.
A casting like that above has only ¼ to ⅜ inches of machine stock on all surfaces, requiring very little machining compared to solid chunks. Cast-to-shape tooling is especially economical when working with intricate shapes.

Allegheny Ludlum, a tool steel producer who makes cast-to-shape materials, casts them with the same precise quality control for which their tool steels is known. A full line of cast-to-shape tool steel grades is available. You'll find ones with high resistance to abrasion, compressive strengths of approximately 400,000 psi, easy machinability, hardening with almost no distortion, toughness, high red hardness, and the capacity to take a high polish.

Find out now how you can cut costs on your complex tools. Write for FC-4, a 28-page technical discussion of A-L's Forging and Casting Division with applications, pattern information, design tips, analyses, and heat treating instructions. Or call your nearest A-L tool steel warehouse or distributor.
ALLEGHENY LUDLUM STEEL CORPORATION, OLIVER BUILDING, PITTSBURGH 22, PENNA.
Write to Dept. TE-3.

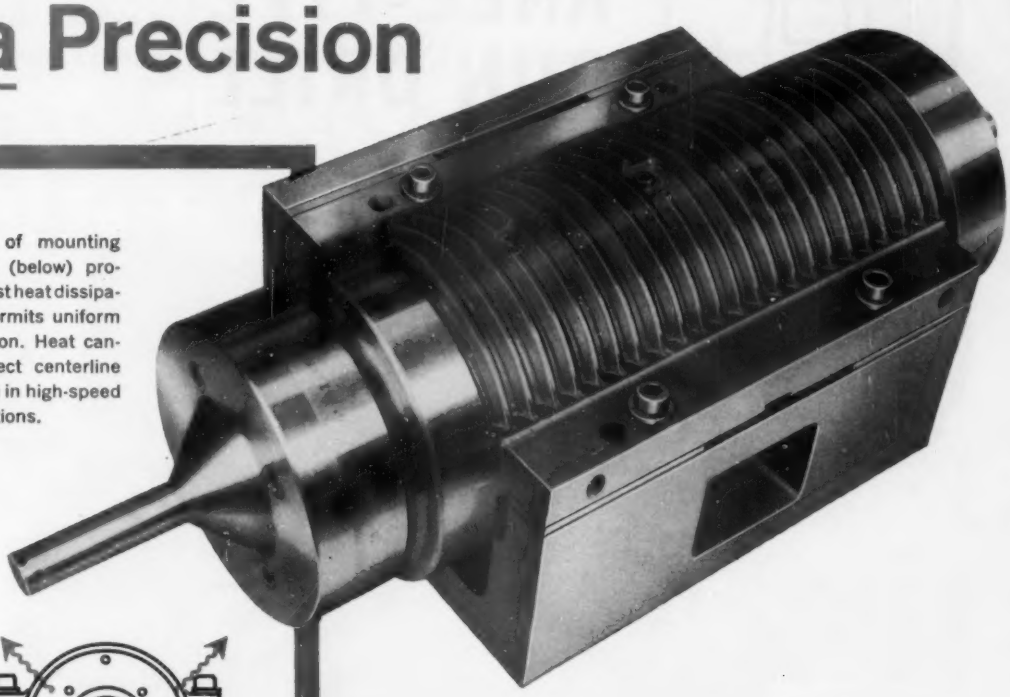
7879

ALLEGHENY LUDLUM

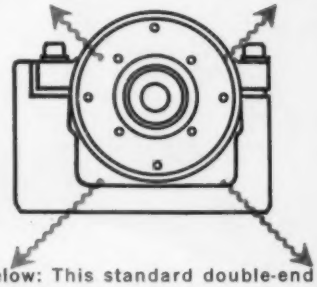
Tool Steel warehouse stocks throughout the country . . . Check the yellow pages

EVERY GRADE OF TOOL STEEL . . . EVERY HELP IN USING IT

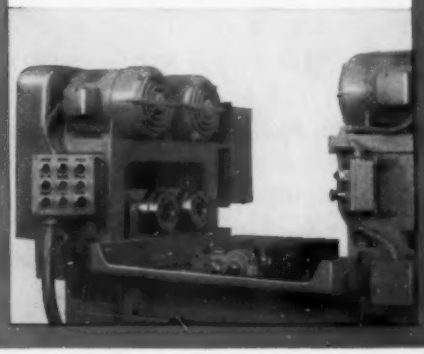
NEW Ex-Cell-O Spindles for Ultra Precision



Design of mounting bracket (below) provides fast heat dissipation, permits uniform expansion. Heat cannot affect centerline position in high-speed applications.



Below: This standard double-end Ex-Cell-O Precision Boring Machine provides a steady platform for the ultra-precision boring job described at right.



The special spindle shown above is one of 16 identical Ex-Cell-O Ultra Precision Boring Spindles recently developed for an extremely demanding boring operation.

Customer specifications called for a guaranteed maximum allowable .00003″ on roundness, with a 10 RMS or better surface finish. The spindles Ex-Cell-O delivered have consistently held .00002″ on roundness, with a 6 micro-inch surface finish (and the customer has ordered duplicates)!

Why do the new Ultra Precision Spindles and other standard and special Ex-Cell-O Boring and Grinding Spindles give consistently greater accuracy, finer finishes and longer, trouble-free life?

The answers are: Engineering and production experience (more than 40 years); exclusive design and construction (using famous Ex-Cell-O Spindle Bearings); and job-tailored availability (Ex-Cell-O offers the most comprehensive line of belt-driven, air-driven, motorized and high-frequency spindles available today).

Need fast delivery of Precision Spindles for original equipment or replacement use? Call your Ex-Cell-O Representative today, or contact Ex-Cell-O in Detroit.

60-85

EX-CELL-O FOR PRECISION

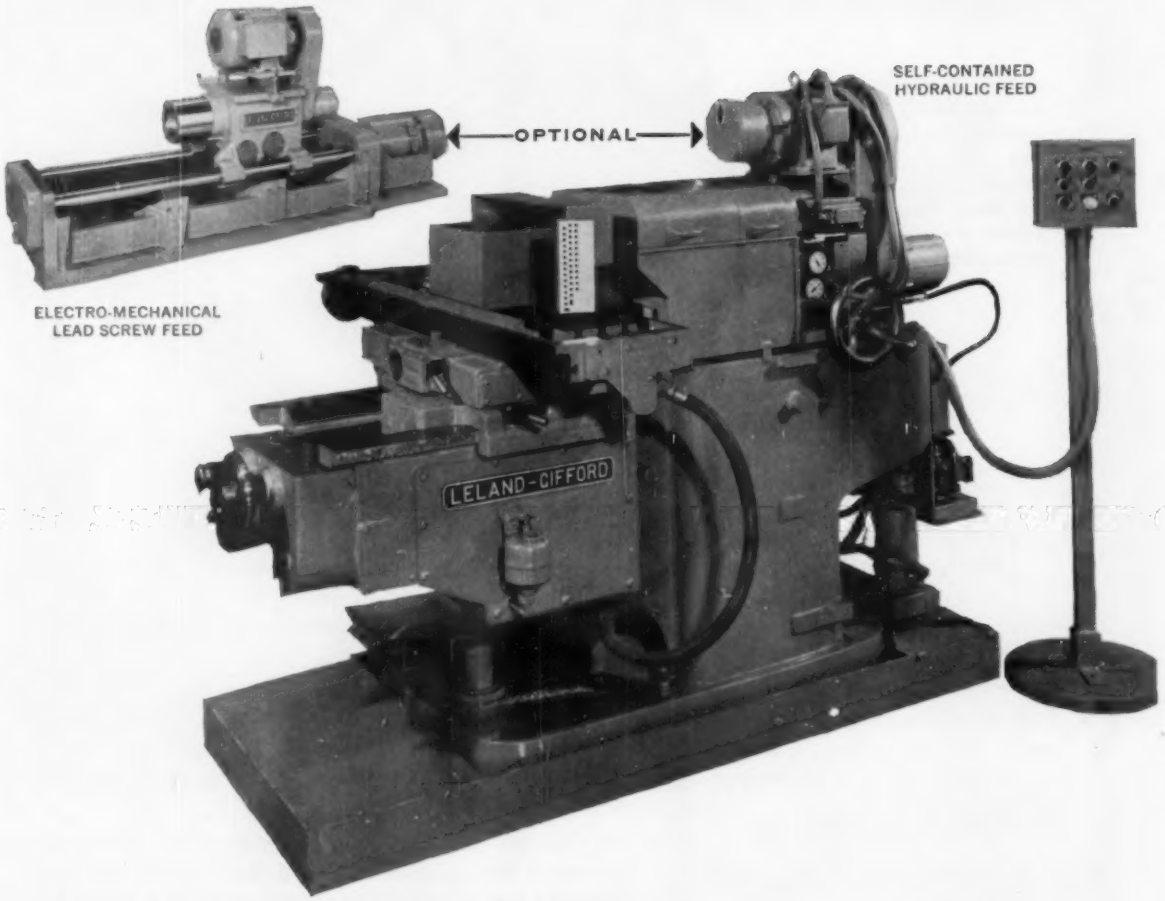
PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

NEW LELAND-GIFFORD KNEE-TYPE GUN DRILL

- Does High Precision Work
- Handles Many Jobs
- Cuts Fixturing Costs



AVAILABLE WITH HYDRAULIC OR LEAD SCREW FEED

For gun drilling smooth, round, straight, deep holes up to ¾" diameter in ferrous or non-ferrous materials, consider the advantages of this Leland-Gifford Universal Gun Drill:

Coordinate elevating, traversing and swiveling of the table eliminates much expensive fixturing. You can handle a wide variety of jobs quickly and economically.

Available with hydraulic or lead screw feed. Choose the feed unit best for your range of hole diameters and depths.

There are few holes too deep, too small or too accurate to be drilled with this modern, capable gun drilling equipment.

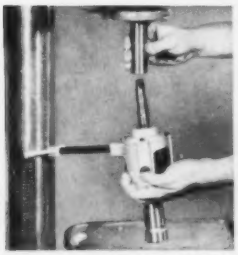
For complete information, write for detailed bulletin — or ask to have an experienced sales engineer call.

LELAND-GIFFORD
WORCESTER 1, MASSACHUSETTS

DRILLING MACHINES

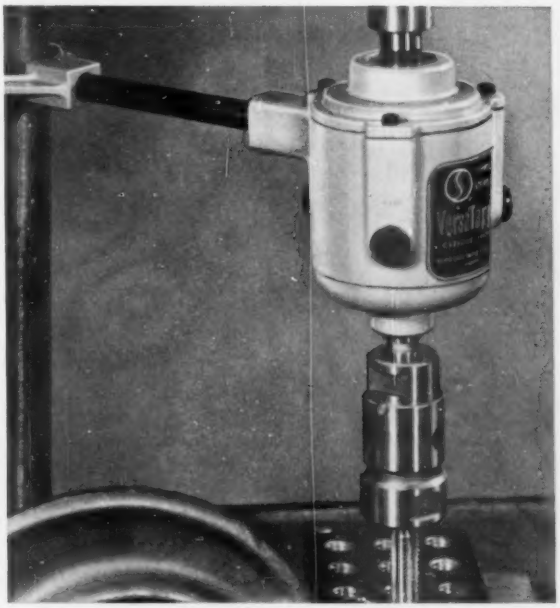
iT'S A FACT!

You can tap 1/2" holes with a light drill press and Supreme's New VersaTAPPER®



Shaft of Model 6100 is held in drill press chuck. No. 6200 (above) has Tapered spindle.

Supreme Accutap Chuck is standard equipment with VersaTAPPER. Capacity 0-½"



VersaTAPPER is a compact precision-made tapping unit. Fits any drill press... features 0 to ½" capacity range plus 4-time increase in torque. Easy to install. Simple and quick to remove after use.

VersaTAPPER...
operates easily in any material
...with widest capacity range
...yet costs far less

JUST $63 COMPLETE

The *new* VersaTAPPER has scored an instant success with production people everywhere. It has more versatility than other tapping devices. It has the *widest capacity range*—from 0 to ½". It develops *more power*—makes the tapping of ½"-13 holes a simpler matter, even with light duty drill presses. VersaTAPPER is *simple to use*—can be successfully operated by anyone in your shop.

All of these features at the remarkably low price of $63 complete marks VersaTAPPER as a product you must see at the first opportunity. It's available at your local Supreme Chuck distributor. Call him soon. Also check number on the reply card in this magazine for literature.

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PRODUCTS CORPORATION
2222 S. CALUMET AVENUE • CHICAGO 16, ILLINOIS

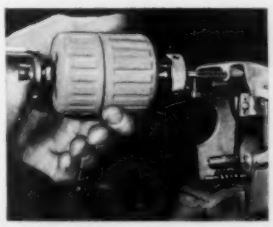
You get more from power tools with Top Quality Supreme Accessories

Supreme Brand Chucks

Noted for unmatched quality. The widest range of sizes and types...one for every machine in your shop. Exclusive Supreme hardening means greater accuracy—longer wear.

Supreme Versamatic

Reversible speed reducer for portable drills. Fits all makes —permits their use for power screw driving, nut running and heavy duty drilling. 7 to 1 reduction means high torque increase. *A fine tool.*



Supreme Push-Pull Tapper

Like the Versamatic, but made for the single purpose of tapping with portable drills. Reverses instantly for tap removal. Handles taps up to 5/16" diameter. Top quality. Simple to operate.

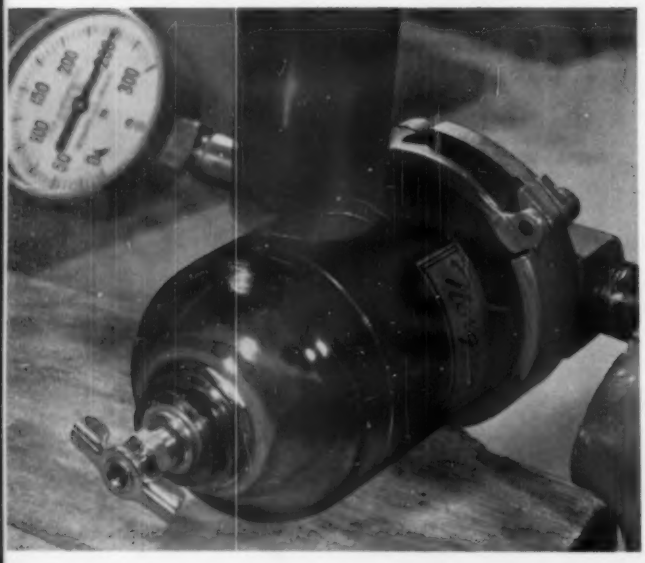
SUPREME PRODUCTS ARE IN STOCK IN YOUR CITY. CALL YOUR DISTRIBUTOR

PRECISION ASR PRODUCTS

NEW NORGREN SAFETY GREEN* TRANSPARENT BOWL WITHSTANDS RIPPING IMPACT OF BULLETS

*TRADEMARK

Norgren SAFETY GREEN* bowl doesn't shatter... yet is fully transparent



Heavy steel bar dropped endwise from 12 ft. height merely scuffed surface of bowl carrying over 200 psi internal pressure.

Bowls for compressed-air-line filters and lubricators should be transparent to permit quick visual inspection. However, in the past, unusual or special applications often required the use of bowl guards or wire reinforcements . . . sacrificing the advantage of transparency.

Now . . . from Norgren . . . you get a fully transparent, yet super-tough, impact-resistant bowl designed for even the most severe service. As these photos dramatically portray, the new Norgren bowls are transparent and are able to withstand conditions far more exacting than ever encountered in ordinary use. Non-shattering bowls mean reduced replacement cost, less air-tool and equipment down-time, savings in maintenance and operating costs, greater employee safety.

These new SAFETY GREEN* bowls are now available for most Norgren air-line filters and lubricators—or may be obtained separately for replacement purposes from your local Norgren representative or distributor. Or, write for full information.

As a further test of toughness, the new Norgren bowl was placed in a heavy machine shop vise . . .

then compressed almost flat. Even in this extreme position, the bowl did not break or even crack.

Turned and squeezed again back to its original shape, the bowl still showed no cracking. Except for vise marks almost good as new!

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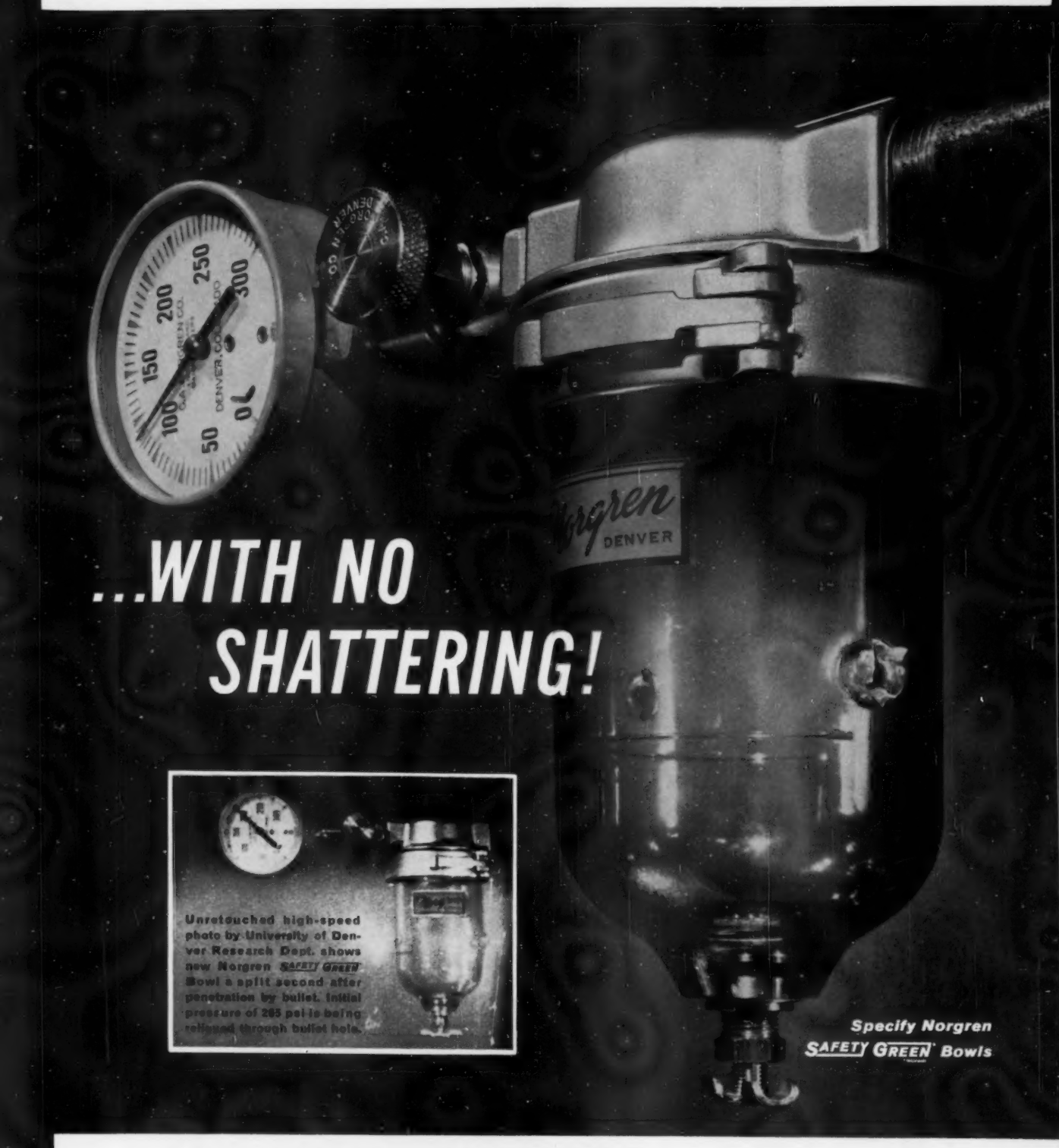

Large photo shows bowl after test. Only damage to bowl is clean bullet hole with no cracking, crazing or shattering. Impact has broken gauge. This test clearly demonstrates extreme toughness of Norgren SAFETY GREEN bowls.

FOUNDED IN 1926

. . . for complete information, write

C. A. NORGREN CO.

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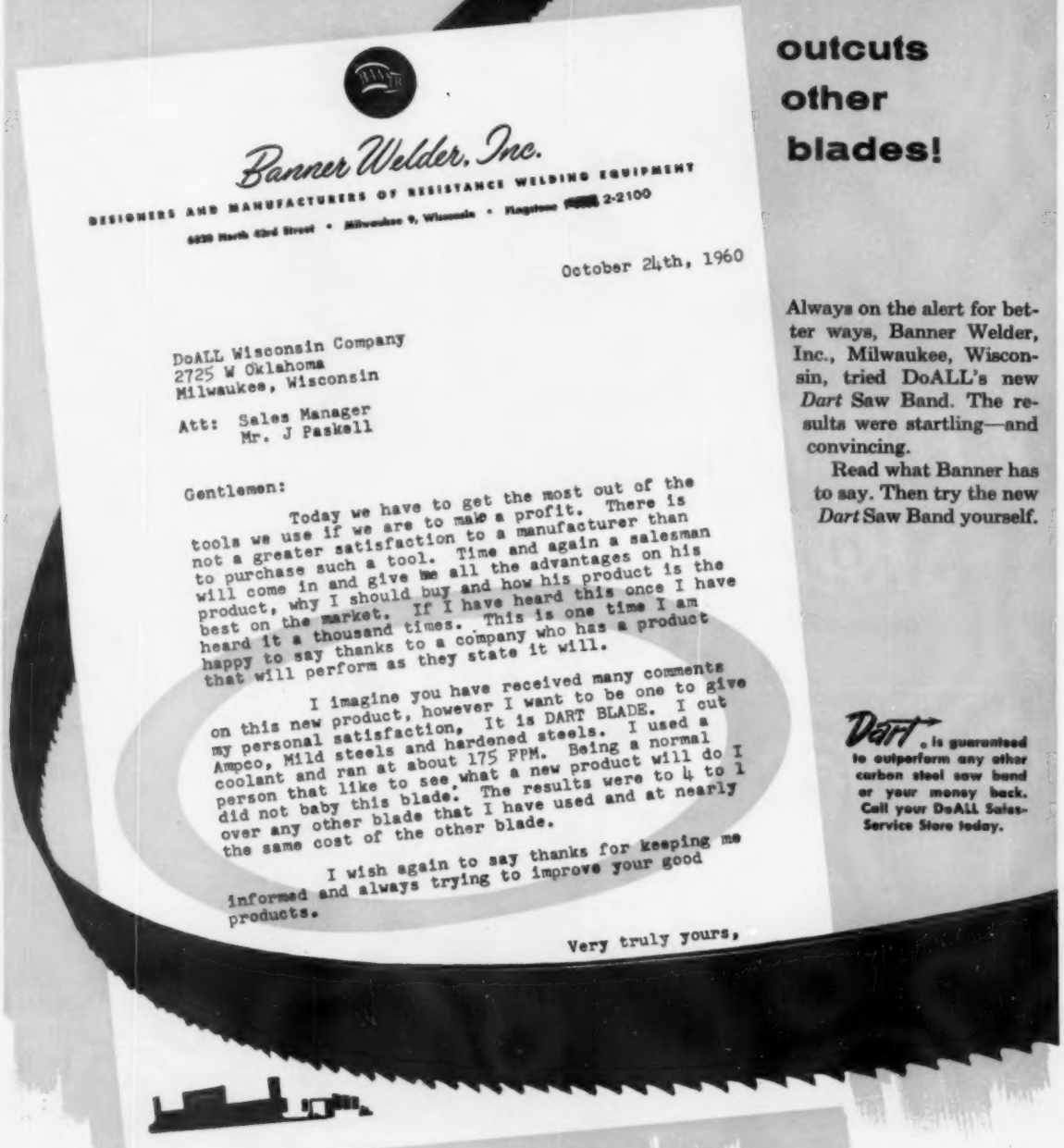
DoALL'S NEW *Dart* SAW BAND...

outcuts other blades!



Banner Welder, Inc.

DESIGNERS AND MANUFACTURERS OF RESISTANCE WELDING EQUIPMENT

6939 North 43rd Street • Milwaukee 9, Wisconsin • Flagstone [illegible] 2-2100

October 24th, 1960

DoALL Wisconsin Company
2725 W Oklahoma
Milwaukee, Wisconsin

Att: Sales Manager
Mr. J Paskell

Gentlemen:

Today we have to get the most out of the tools we use if we are to make a profit. There is not a greater satisfaction to a manufacturer than to purchase such a tool. Time and again a salesman will come in and give me all the advantages on his product, why I should buy and how his product is the best on the market. If I have heard this once I have heard it a thousand times. This is one time I am happy to say thanks to a company who has a product that will perform as they state it will.

I imagine you have received many comments on this new product, however I want to be one to give my personal satisfaction, It is DART BLADE. I cut Ampco, Mild steels and hardened steels. I used a coolant and ran at about 175 FPM. Being a normal person that like to see what a new product will do I did not baby this blade. The results were to 4 to 1 over any other blade that I have used and at nearly the same cost of the other blade.

I wish again to say thanks for keeping me informed and always trying to improve your good products.

Very truly yours,

Always on the alert for better ways, Banner Welder, Inc., Milwaukee, Wisconsin, tried DoALL's new *Dart* Saw Band. The results were startling—and convincing.

Read what Banner has to say. Then try the new *Dart* Saw Band yourself.

Dart is guaranteed to outperform any other carbon steel saw band or your money back. Call your DoALL Sales-Service Store today.

53-87

This is a typical DoALL Store

The DoALL Company, Des Plaines, Illinois

Call Your DoALL Sales-Service Store

Machines and Blades · Surface Grinders · Power Saws — MACHINE TOOLS · CUTTING TOOLS · MEASURING INSTRUMENTS · SHOP SUPPLIES

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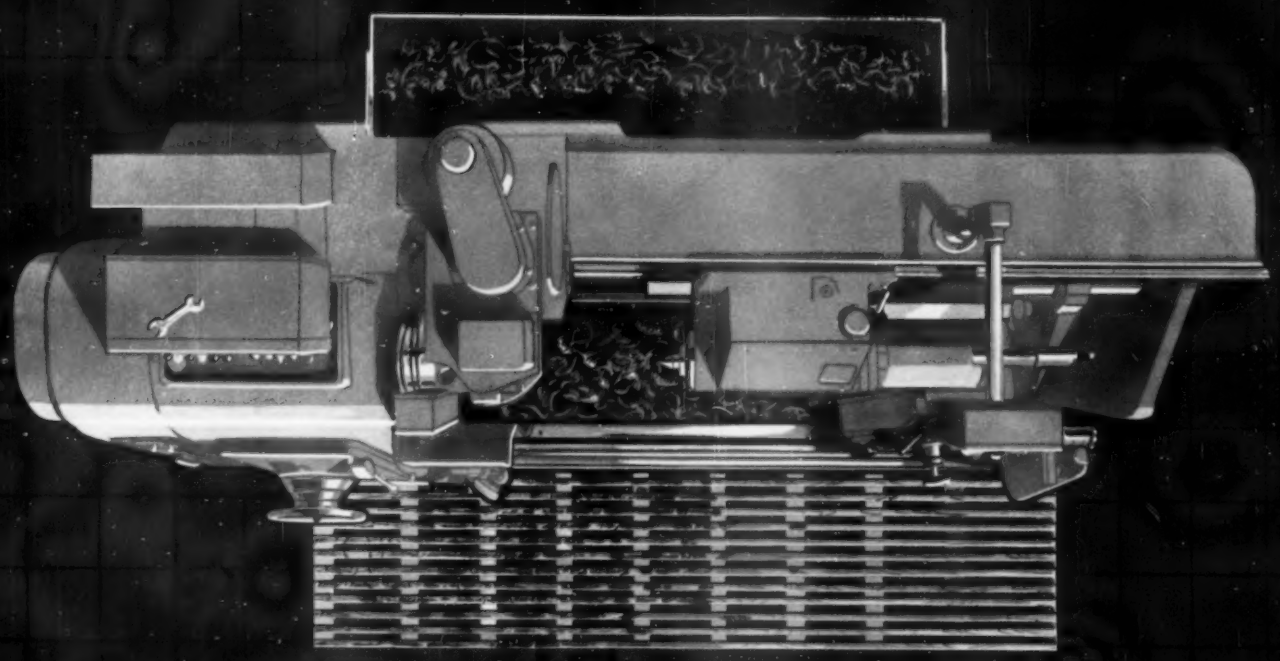
Use Reader Service Card, CIRCLE 35



You can turn a profit on a New Britain +GF+ Copying Lathe

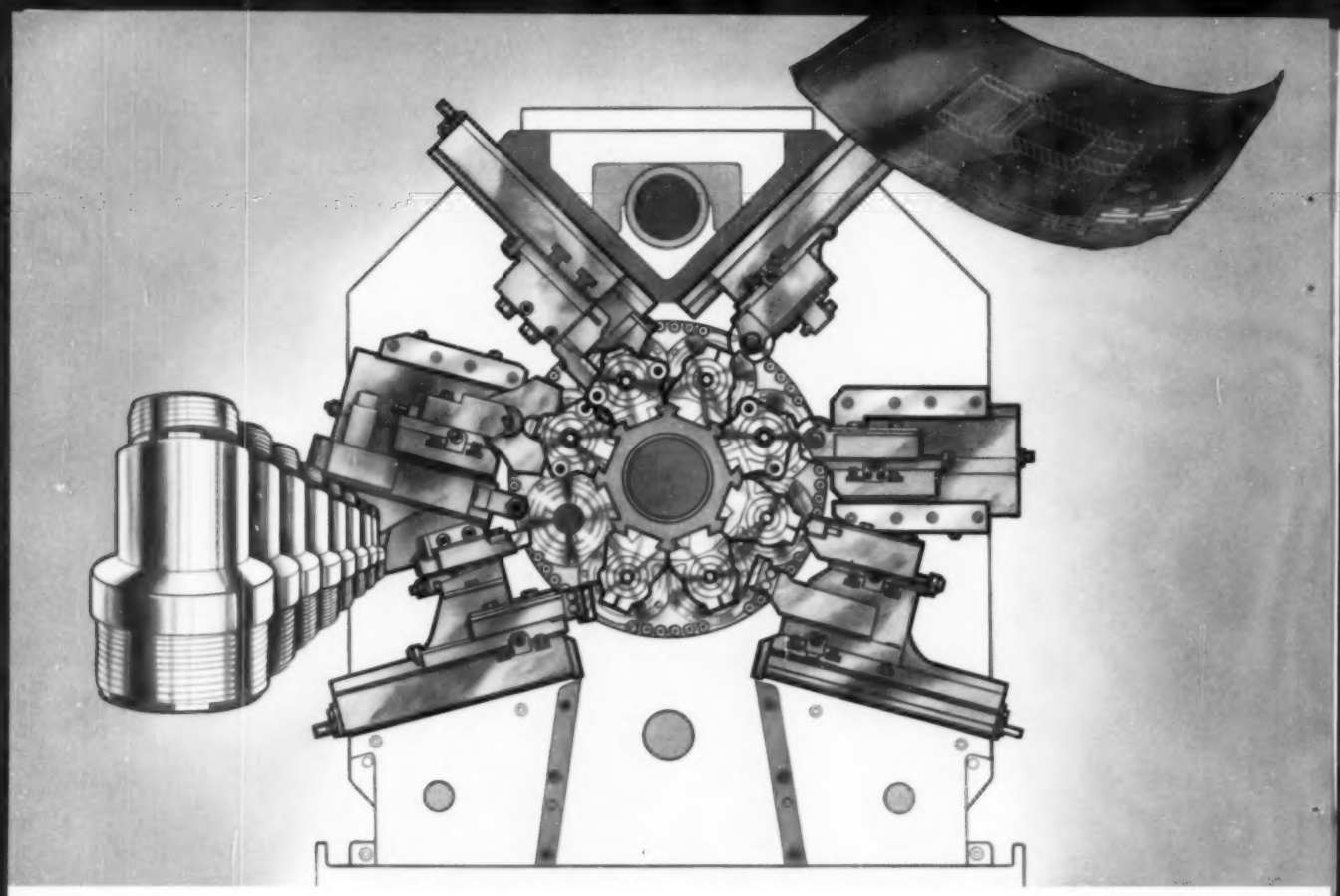
Here's a birdseye view of a New Britain **+GF+** Copying Lathe. It shows some important differences between this machine and conventional lathes with copying attachments. The point here is this—*the most effective use of the single-tool copy-turning principle can be made only with a machine designed from the ground up for this type of work.* The New Britain **+GF+** is just such a machine. Notice the chip pan. It's big (it has to be) and located for easy removal of chips from the back of the machine. The design of the work area allows for unobstructed free-fall of chips out of the way and into the pan.

The New Britain **+GF+** is massive and rugged, with plenty of power—up to 40 h.p., if you need it. It's simple to operate, quick to set up and change over. The single-point tool can be changed in one minute and it out-produces gang tooling setups in the bargain. Turning is controlled by either a template or a prototype. External and internal copying are accomplished in one set-up with special tooling.

The possibilities for short or long run chucked and between centers work on the **+GF+** are wide and varied. Because the work is produced with good surface finish and dimensional accuracy, grinding can be reduced and, in some instances, eliminated. Large diameters are broken down economically by successive parallel cuts, automatically if desired, with optional two-cut or multi-cut recycling.

You've got to see one of these machines in action to fully understand the kind and quantity of work they are capable of producing. Contact your New Britain Representative for demonstration arrangements or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut



Unlimited tooling combinations with New Britain Bar Machines

Nothing can out-date your operation quicker than better machines in the hands of a competitor. In the race to keep ahead on quality, price and delivery, nothing can put you out front faster than machines capable of consistently producing the highest quantity of finished pieces at the lowest possible cost. New Britain's new series of bar machines represents in every way the most advanced bar-turning units available. Each of the four-, six- and eight-spindle models has been redesigned, adding new features and improving older ones. Unlimited cross slide and end-working tool combinations, extremely fast operation (even on stainless) and a variety of models and features to choose from add up to some good reasons for incorporating New Britains into your replacement or production expansion plans.

The eight-spindle model is the largest, most modern eight-spindle bar machine available. It has a stock capacity of up to 2⅝" and provides six independently-operated cross slides. As with all New Britain bar machines, the operations of the cross slides and end-working tool slide are disc-cam controlled for positive actuation, close tolerance machining and easy, rapid change-overs.

This is only a very small part of a story that is bound to interest you. The whole story and its significance in terms of your profits is available from your New Britain Representative. If you prefer, contact us directly at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut

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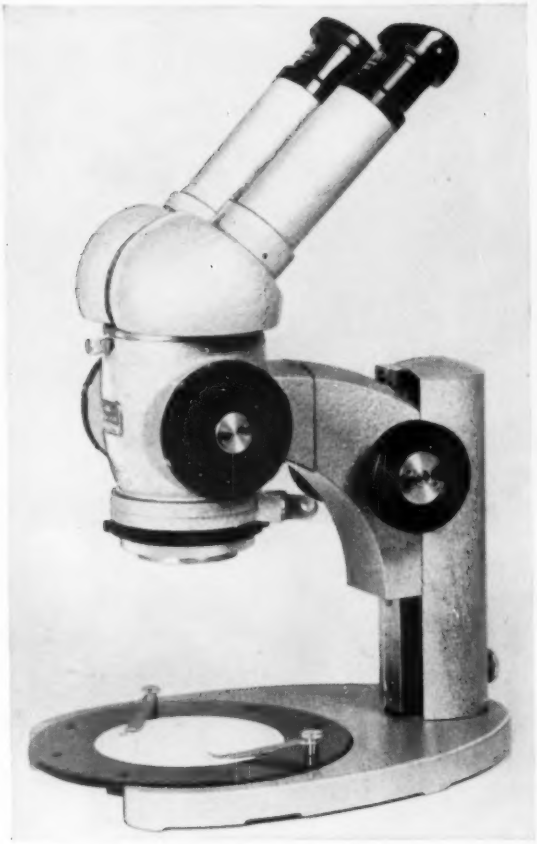
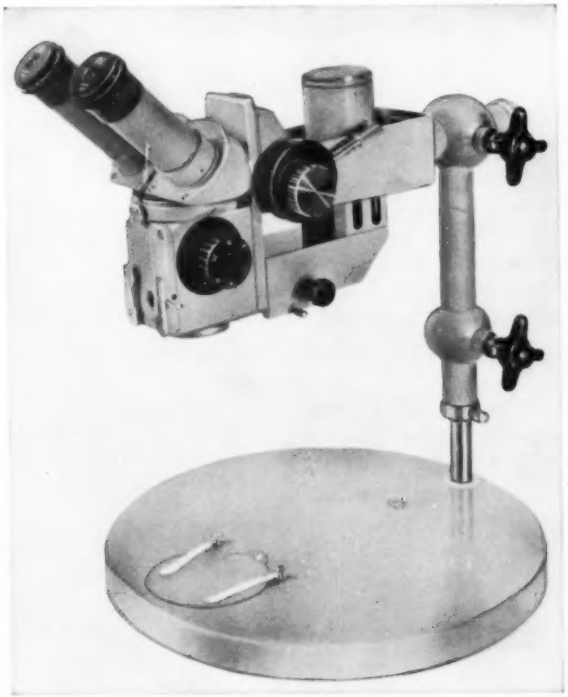
WEST GERMANY

NEW Stereo Microscope II

Produces an image of outstanding plasticity—erect, unreversed, and uniformly sharp over the entire field of view . . . Easy on the eyes, even under prolonged observation . . . Novel, rapid change of magnification from 2.5x to 100x, with wide-angle oculars . . . Large working distance—3⅛"—with diameter of object field up to 50mm. Beyond 100x magnification, a 2x supplementary objective is available, having a working distance of 1⅛".





EPI-Technoscope

A modern stereoscopic binocular microscope eminently suited for industrial inspections and examinations. Intense illumination parallel with line of vision. Erect, plastic image even in deep cavities. Free working distance of 8 inches. Magnification changing device provides rapid succession of 6.3x, 10x, 16x, 25x and 40x magnifications.

Write for literature on these advanced instruments

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COMPLETE SERVICE FACILITIES

You get peak performance only with quality tools

When only the best cutting tools are good enough, always specify CLEVELAND *Quality* Tools. They are the *finest* you can buy . . . and also the *most economical.*

Our intensive program of quality control starts with the raw materials from which the tools are made. Not only does our Laboratory devote a great deal of attention to specifying and inspecting raw materials, but we also work closely with the suppliers of our high speed steels and carbides to assure that consistently high quality is maintained.

Thus we make doubly sure that every shipment meets our exacting requirements before it is accepted and placed in stock, as shown in the photograph. This establishes a firm foundation for the subsequent heat treating, milling, grinding and other operations through which the steel must pass before the ◈ trademark is placed on the finished tools.

Telephone your Industrial Supply Distributor. He can give you prompt delivery of CLEVELAND Quality Tools from stock, and can make arrangements for one of our trained Service Representatives to help you solve your cutting tool problems.

THE CLEVELAND TWIST DRILL CO.
Cleveland 1, Ohio

QUALITY CUTTING TOOLS • BEST SERVICE THROUGH YOUR LOCAL DISTRIBUTOR

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Don't settle for less than the best

BAY STATE Taps and Dies are the highest quality . . . consistently.

This assurance of quality is the result of carefully controlling every step in manufacturing. From precise selection of the best steel, through every operation and many inspections, no effort is spared to produce *the best.*

One of the operations is precision thread grinding, illustrated above. Here, as elsewhere in the complex process of making threading tools, *quality* is built into BAY STATE Taps and Dies by skilled craftsmen and modern equipment.

That's why BAY STATE Taps and Dies give you better performance. Don't settle for anything less than the best!

Sold through Industrial Supply Distributors, BAY STATE *Quality* Taps and Dies are always available when you need them—and at lower cost than would be possible with any other method of distribution.

BAY STATE TAP and DIE CO.
Mansfield, Mass.
Subsidiary of The Cleveland Twist Drill Co.

QUALITY BAY STATE CUTTING TOOLS • BEST SERVICE THROUGH YOUR LOCAL DISTRIBUTOR

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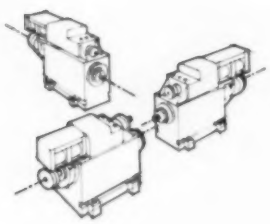
More accurate and more versatile than machines costing 15 times as much

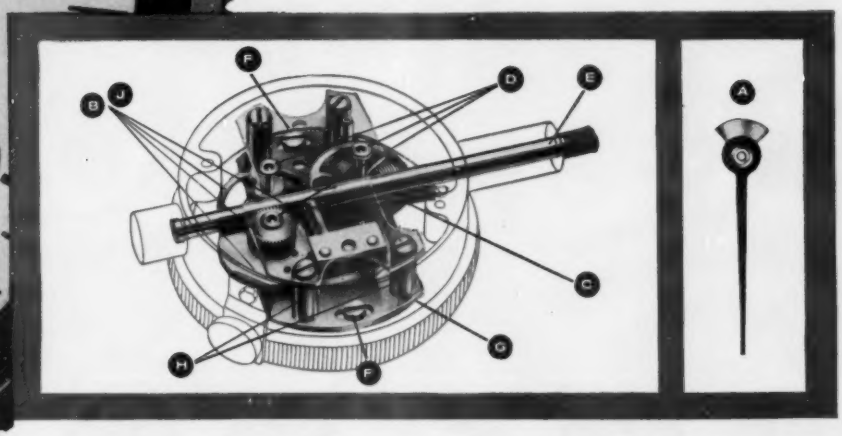


For precision miniature boring, this Whitnon reciprocating spindle has outperformed boring machines costing tens of thousands of dollars. Versatile in concept, it can be positioned and re-positioned on a surface plate, for complete flexibility. Versatile in operation, its fast infeed, controlled boring feed, and dwell time are all instantly and easily variable. Accurate in performance, its rotational error is less than .00003", micrometer depth control repeats to within .0002", with a travel error of less than .00005" over the entire 2" travel range. Optional drive and tool-mounting details are offered, and there's a larger version of the unit—with a travel range of 4"—which maintains the identical base-to-shaft-centerline dimension so the units can be intermixed in the same work set-up. Further details on request.

THE WHITNON MANUFACTURING CO., RT. 6 AND NEW BRITAIN AVE., FARMINGTON, CONN.

You get all these *Plus Features* only in Federal Indicators

Full Jeweled Bearings, Unit Construction, Low Inertia Indicating Hand, Miracle Movement — each of these advancements pioneered by Federal has a particular significance to you in terms of better performance. AND, with all these *plus* features, Federal Dial Indicators generally sell for LESS due to their wide acceptance which has made possible the economies of quantity production. Here are the features and reasons why they are important:



A **Functionally designed Indicating Hand** balanced for low inertia, provides greater sensitivity and better repeat accuracy. Hand has highest strength-to-mass ratio to preserve position and shape under heavy gaging action.

B **Precision-made, Stainless Steel Gears, Rack and Pinion,** for a rustproof, smoother running, more accurate movement.

C **Positive Contact** with minimum pressure for faithful indicator response.

D **Full Jeweled Bearings** reduce friction, for improved accuracy over a longer period of time.

E **Precision Fit** of spindle and bearing for better repeat accuracy.

F **Accurate Movement Positioning** for optimum rack and gear alignment. Provides extremely close and positive control over a critical fit in *every* indicator.

G **Unit Construction** for easy maintenance and adjustment.

H **Rigid Assembly** of top and bottom plates for accurate gear alignment essential to minimum wear.

J **Gear and Rack Teeth** are hobbed with micro precision so that each Federal Indicator provides uniformly high accuracy throughout its *full* range.

MIRACLE MOVEMENT

For complete story on Miracle Movement, write . . .

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Ask FEDERAL *First*

for recommendations in modern gages . . .

Dial Indicating • Air • Electric, or Electronic — for inspecting, measuring, sorting, or automation Gaging

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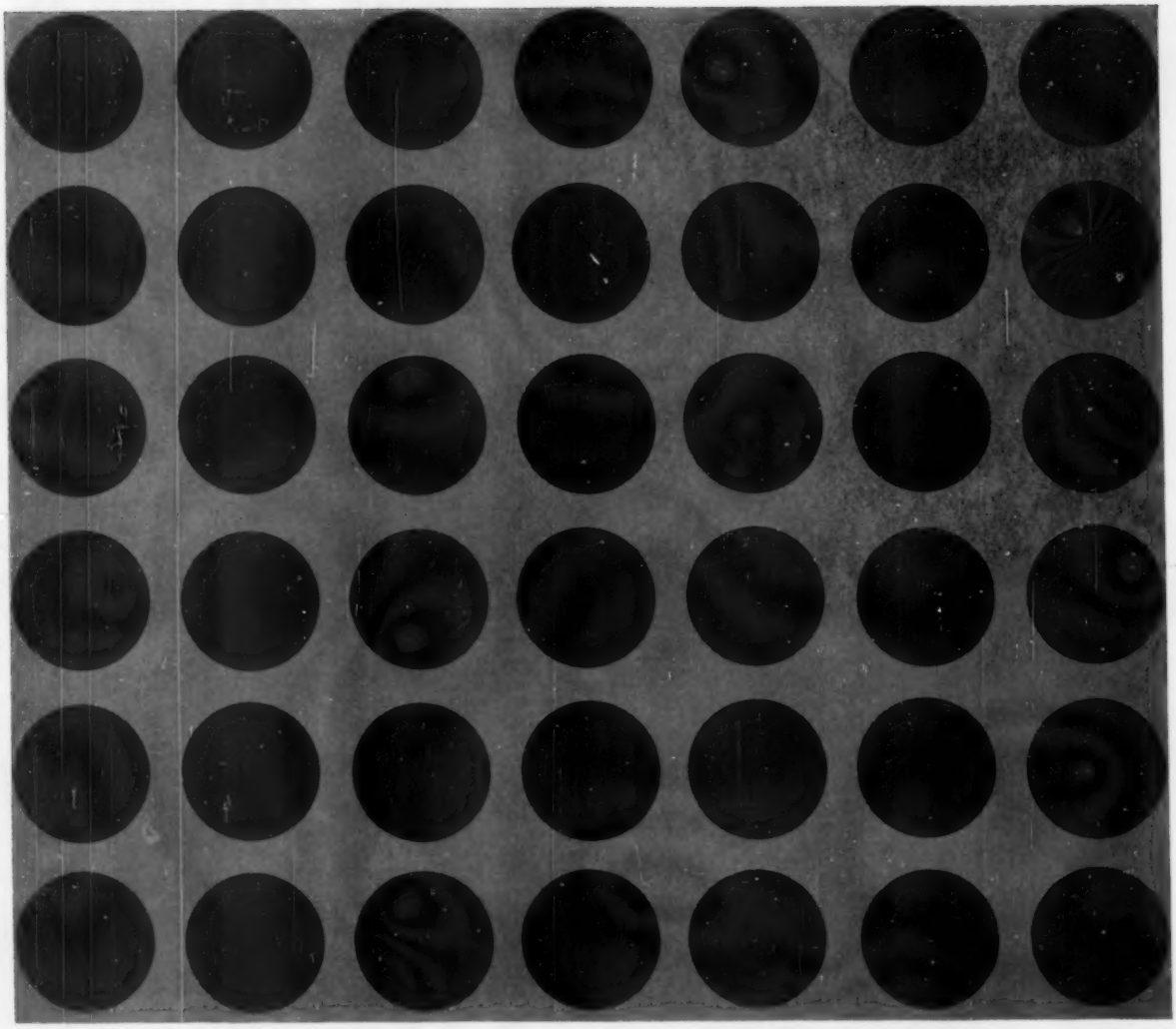

(Fit 3/16" Pin)

(Clear #8 Machine Screw)

(Clear 163-175 Stud)

(Clear #8 Tapping Screw)

(Clear 5/32" Rod)

(Fit 3/16" Rivet)

(Tapping Hole for #14-10 Screw in 19 and 20 gauge steel)

Use one 3/16" P.U.P.S. to make holes for all these applications!

Doesn't it just make good sense to use one size punch to make one size hole regardless of the way the hole is to be used? If you're using many different size punches to make the same hole over and over, you need to ask your Dayton Perforators Distributor for the facts about sensible Proven Usage Punch Sizes! For his name and illustrated literature, write Dayton Perforators, Inc., Dayton 4, Ohio.

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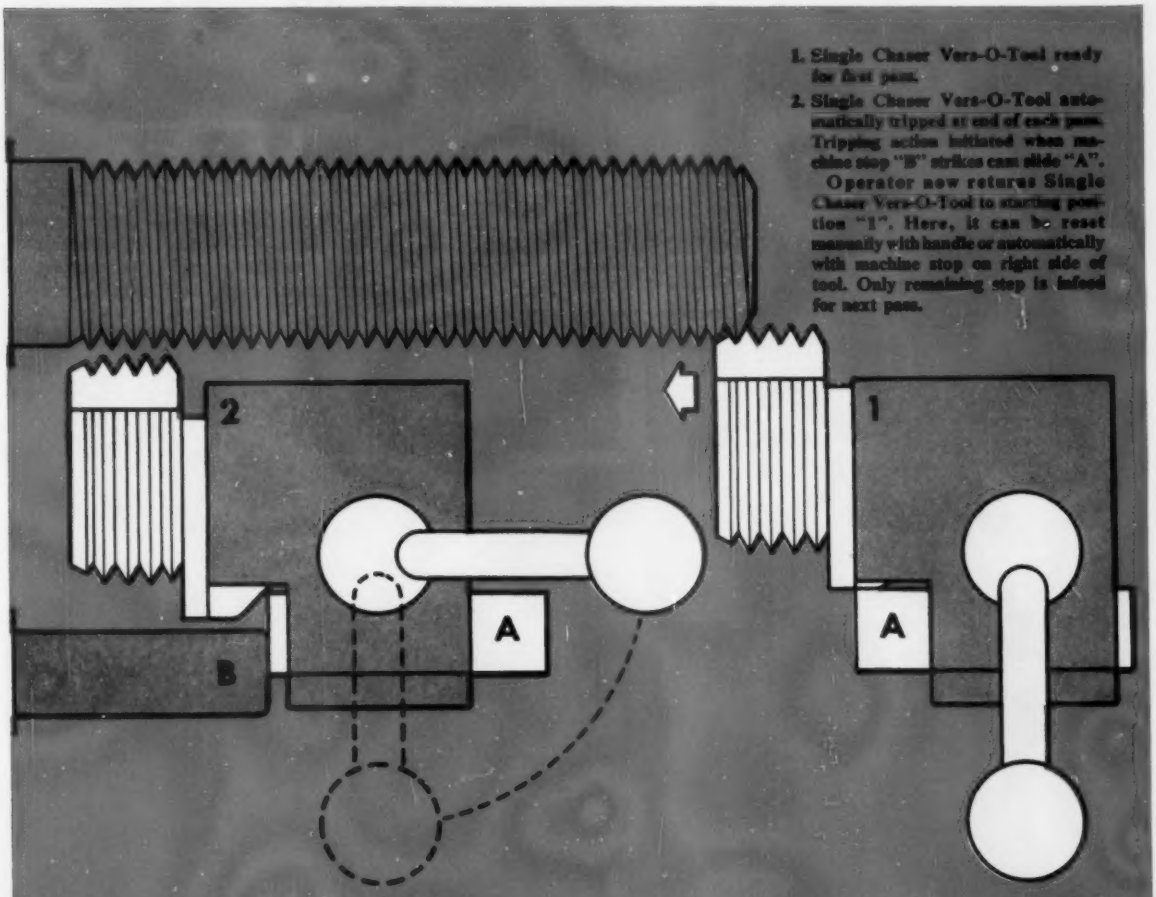
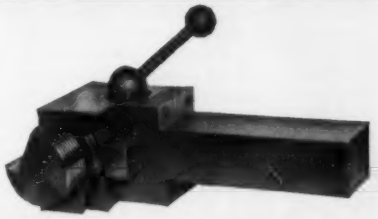


Only NAMCO's Single Chaser Vers-O-Tool

Trips Automatically . . . Boosts Short Run Threading Efficiency

Unlike other single point threading tools, NAMCO's Single Chaser Vers-O-Tool backs off automatically at the end of the cutting stroke. For short runs, this means more threading in less time. And, because it just isn't possible to attempt the return stroke while the tool is still at cutting depth, scrappage is eliminated. The tool's multiple cutting edges mean greater threading accuracy and longer tool life while NAMCO's exclusive resharpening method permits quick tool change and precise reset. In short, *nothing* beats NAMCO's Single Chaser Vers-O-Tool for short run threading efficiency. Get complete details on this and all the rest of NAMCO's complete line of Vers-O-Tools. Write today for our 44 page Bulletin DT-60.



National Acme

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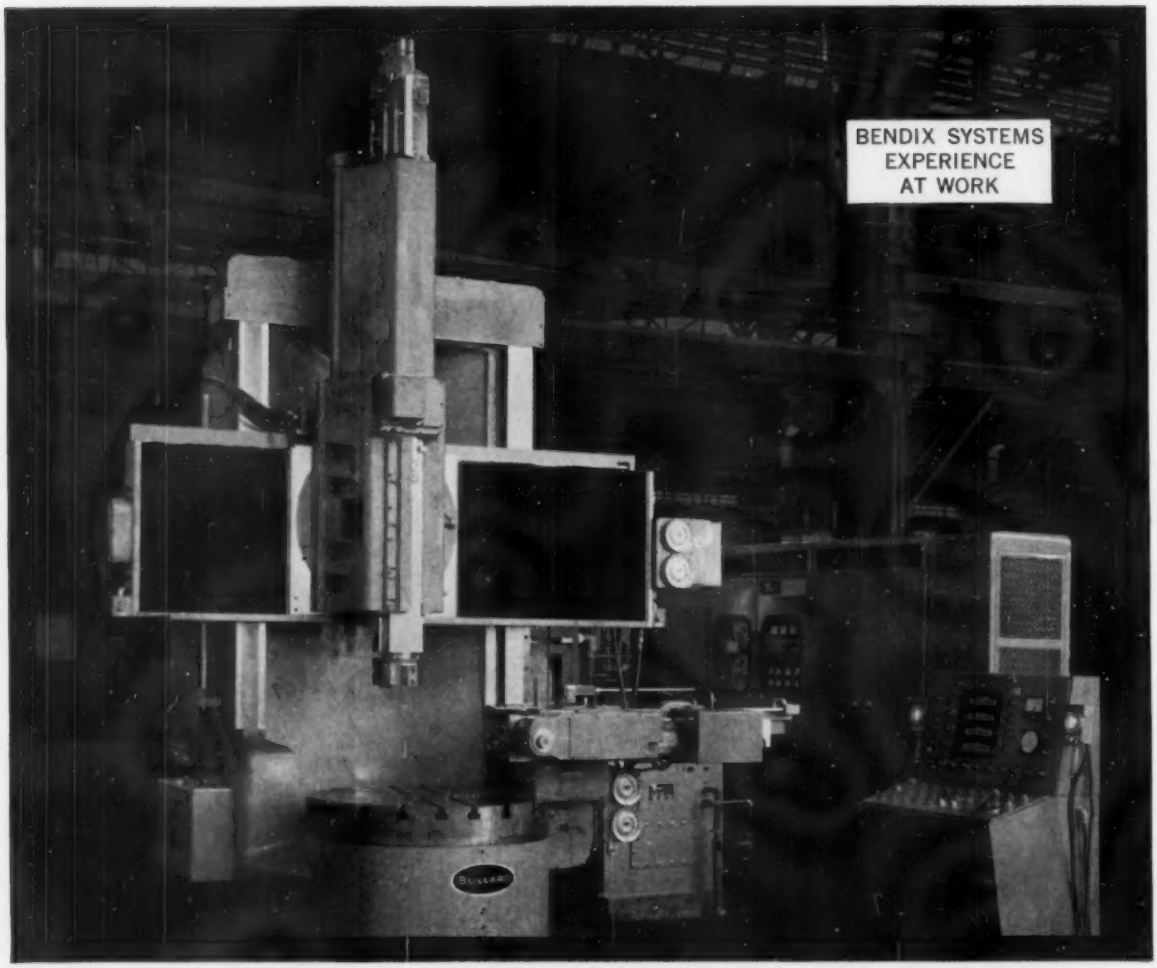


BENDIX SYSTEM ENGINEERING PROVIDES OPTIMUM NUMERICAL CONTROL FOR TURRET LATHE

Shown above is a Bullard four-axis vertical turret lathe equipped with Bendix DynaPath-14 contouring control unit. In this application, the selection of tools and spindle speeds is programmed, as is the motion of both slides.

Bendix application engineers, with accumulated experience in mechanical and hydraulic analysis of machine tools, worked closely with Bullard to produce this wedding of machine tool and numerical controls. And Bendix systems experience gained in working on other contour turning applications (with such companies as Ex-Cell-O, Heald, and Giddings & Lewis) assures the user correct application of control unit to machine tool.

In addition to contour turning applications, Bendix engineers numerical control systems for milling, grinding, drilling and jig boring machines. We have developed and applied controls to 2-, 3-, 4-, and 5-axis systems, both continuous path and point-to-point. These controls are being used daily in plants across the country to increase machine tool efficiency, reduce lead times, and make parts of consistently high accuracy.

Bendix SYSTEMS EXPERIENCE can provide the key to your machine tool problems. The right Bendix numerical control unit can be the profit-maker you've been looking for. Start putting Bendix application engineering experience to work for *you*—write today for a copy of our catalog number 308.

BENDIX PROVIDES SYSTEMS EXPERIENCE

JUSTIFICATION STUDIES • SYSTEM ENGINEERING • TRAINING AND SERVICE

Industrial Controls Section

21820 Wyoming Ave., Detroit 37, Michigan

why Ampex uses NIKON OPTICAL COMPARATORS

The new Ampex AR-300, developed principally for military and scientific applications, is the only recorder capable of covering a 4-megacycle bandwidth. It can capture and record phenomena beyond the range of any equipment in use today.

The most vital component in the AR-300 is its rotating recording head, designed to achieve the high, head-to-tape velocity required for wide band response, yet maintaining a relatively low, reel-to-reel speed.

Nothing in the manufacture of the AR-300 proved as critical as the production of this head. Most of its parts did not lend themselves to conventional inspection methods. While .0001" tolerances had to be maintained, Ampex standards call for inspection equipment capable of at least 10 times the required accuracy.

This inspection problem was finally solved when the task was assigned to a Nikon 6 Optical Comparator. Not only did the Nikon Comparator provide the exact measurements required during 'in-process' inspection, but it also permitted consistent duplication of these measurements, time after time.

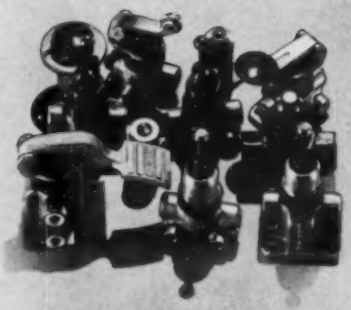
Today, the Nikon 6 has a permanent position on the AR-300 production team. Furthermore, there are now five additional Nikon comparators serving Ampex in other production projects, and in development—helping to maintain the high quality standards for which Ampex products are justly famous.

Why not investigate what a Nikon comparator can do for you? Write for complete, illustrated catalog to Dept. TE-3.

NIKON INCORPORATED, 111 FIFTH AVE., NEW YORK 3, N. Y.

Ferride Coil Under Inspection Showing Size Relationship

why does Logan stock so many AIR AND HYDRAULIC VALVES?



Logan offers a wide selection in size and design of both air and hydraulic valves to meet a demand that has steadily grown over the years.

This effort to be of service beyond the design and manufacture of air and hydraulic equipment has been a vital part of the Logan program since the company was founded.

If you would like more information about valves, or other Logan products, merely fill in the coupon below.

LOGAN

AIR AND HYDRAULIC OPERATED MACHINES

Check the items you want, fill in your name and address, tear out and mail to:

Logansport Machine Co., Inc. • 740 Center Avenue, Logansport, Indiana

___100-1 AIR CYLINDERS
___100-2 MILL-TYPE AIR CYLS.
___100-3 AIR-DRAULIC CYLS.
___100-4 AIR VALVES
___100-5 LOGANSQUARE CYLS.
___100-6 ULTRAMATION CYLS.
___100-7 SUB-PLATE AIR VALVE
___300-1 CHUCKS
___300-2 PRESSES
___200-1 HYD. POWER UNITS
___200-2 ROTOCAST HYD. CYLS.
___200-3 750 SERIES HYD. CYLS.
___200-4 and 200-7 HYD. VALVES
___200-6 SUPER-MATIC CYLS.
___ABC BOOKLET
___CIRCUIT RIDER
___CALCULATOR
___FACTS OF LIFE

Please send copy of catalog

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TITLE.....

COMPANY.....

ADDRESS.....

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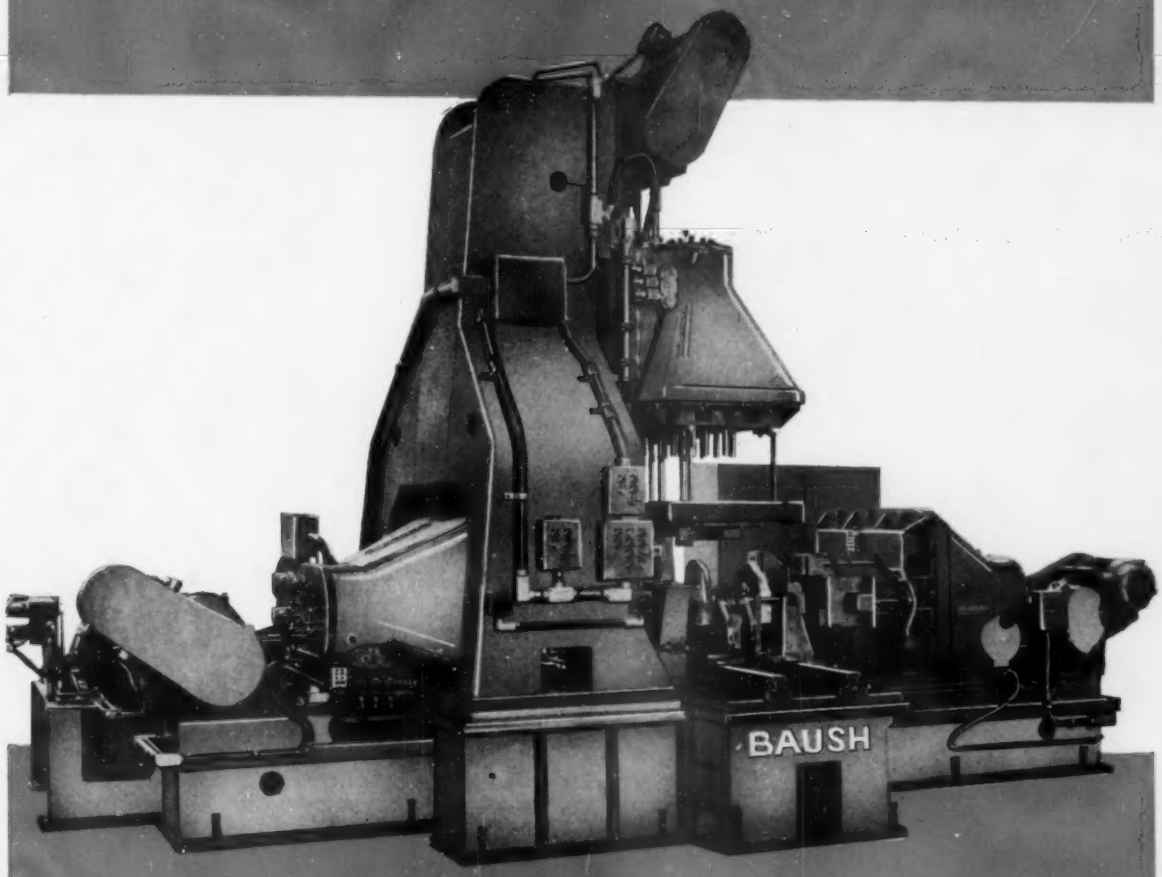
SPECIAL 3-WAY "H-15" AUTOMATIC HYDRAULIC

WITH MULTI-SPINDLES FOR DRILLING AND REAMING TRACTOR PARTS



Baush specifically designed this single purpose machine to speed production for a leading tractor manufacturer. This "H-15" is unique in that by changing the hydraulic unit to a recirculating ball screw the machine becomes a 100% mechanical leadscrew machine.

Three 20" x 30" heads are bored and furnished with 24 spindle pinions, and all spindles are arranged for two (2) speeds and a neutral position. The heads have master-bored cluster plates with a total of 35 slip-sleeve spindles for drilling or reaming.

As illustrated, this machine has automatic hydraulic operation of fixture and slide.

Electrical controls are all J. I. C. Standard, with three (3) of the motors being 15 HP and three (3) 5 HP.

Write for new brochure with complete specifications.

Sections, or all of this type machine are adaptable to working different parts in the future with a minimum of changeover.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

Announcing
CARMET®

700

Series Cutting Grades

to boost production–extend tool life up to 200%

If you're tooling-up for a really tough cut, try Carmet's new 700 Series Cutting Grades. Make one super-duty tool do the work of two or three—on any steelcutting job, including superalloys.

Carmet's 700 Series is a new, premium group of carbide grades just released after exhaustive field trials. Results were conclusive. These carbides stood up under the roughest interrupted cuts going. They gave longer tool life than competitive grades in the same application class. And, they produced exceptionally fine finish cuts, even in C-8 precision boring classifications.

Here are the 700 Series Steelcutting Grades, and their applications:

- **CA-704** Hard and dense for the ultimate in finish cuts and precision boring.
- **CA-711** Ideal for medium to finish cuts in the general purpose category.
- **CA-720** Tough and thermal shock-resistant for medium and heavy cuts, including interrupted cuts.

These new Carmet Grades combine edge wear and crater resistance with an unmatched ability to endure shock. The 700 Series will outperform other groups of tools in any C-5 to C-8 application. Take a look at a few customer trial reports:

"Turning tapered, slotted, forged SAE 4140 valve plugs . . . formerly got 8 finished pieces per cutting edge. Now get up to 25 pieces with CA-720 on a tough, interrupted cut!"

"Turning OD of universal joint ears . . . now getting 177 pieces with CA-720 against 135 with former tool."

"On SAE 1035 rotor shafts . . . got 7 more shafts per tool with CA-711. And K Monel shafts . . . got more from 9 CA-711 tool corners than 12 corners on triangular inserts formerly used."

"On SAE 4320 forgings . . . a whopping 242 pieces with CA-720, against 209 with previous Carmet 600 Grade, 198 with best competing tool."

Remember, for less demanding operations, the 600 Series Cutting Tools will continue to be sold by Carmet. But for the really tough cut . . . when you've got to make chips on a mean, tool-buster of a job . . . this kind of performance from the 700 Series will save you time. And, cost you less than competing premium grades!

They're doing just that in shops all over the country . . . right now! Try them, just once, on your job. Your local Carmet Distributor has them in stock. Contact him for more information, or write: ***Carmet Division, Allegheny Ludlum Steel Corporation, Ferndale, Detroit 20, Michigan. Dept. TE 3-1.***

CARMET AL

CEMENTED CARBIDE • DIVISION OF ALLEGHENY LUDLUM

2890

CARMET 700 SERIES CATALOG SUPPLEMENT NOW AVAILABLE

There's a new Supplement to the Carmet Catalog C-16-B, listing tool and insert styles, and prices for the new 700 Series. Contact your local distributor, or write Carmet direct.

cool · tough

DASCO SUPER SOLUBLE BASE

water-mix cutting fluid

Stuart

Under adverse conditions—on jobs too difficult for regular water-mix cutting fluids, yet not suited for straight petroleum oils—Stuart's Dasco Super-Soluble Base will improve performance and profits, reduce costs.

Here is a water-mix cutting fluid with a sulfochlorinated fatty oil base that assures proper chip formation, prevents welding, and reduces heat-generating friction under extreme circumstances. It is a heavy-duty soluble oil that permits machining of stainless, low carbon steels, monel, and jet engine alloys with economical tool life and fine surface finish. Even at slow cutting speeds, the chemically active extreme pressure additive in Dasco Super-Soluble provides antiweld protection at the tool-chip interface—prevents edge build-up and cratering of tools.

Dasco Super-Soluble gives you high lubricity, antiwear, and antiweld qualities, plus the high cooling capacity inherent in a water-mix cutting fluid. It is ideal for heavy-duty turret lathe work, high-speed turning with carbides, tough form milling, boring, and surface or round-hole broaching. Use it at 40 to 1 for turning, drilling, milling, boring, sawing, and reaming—15 to 1 for broaching.

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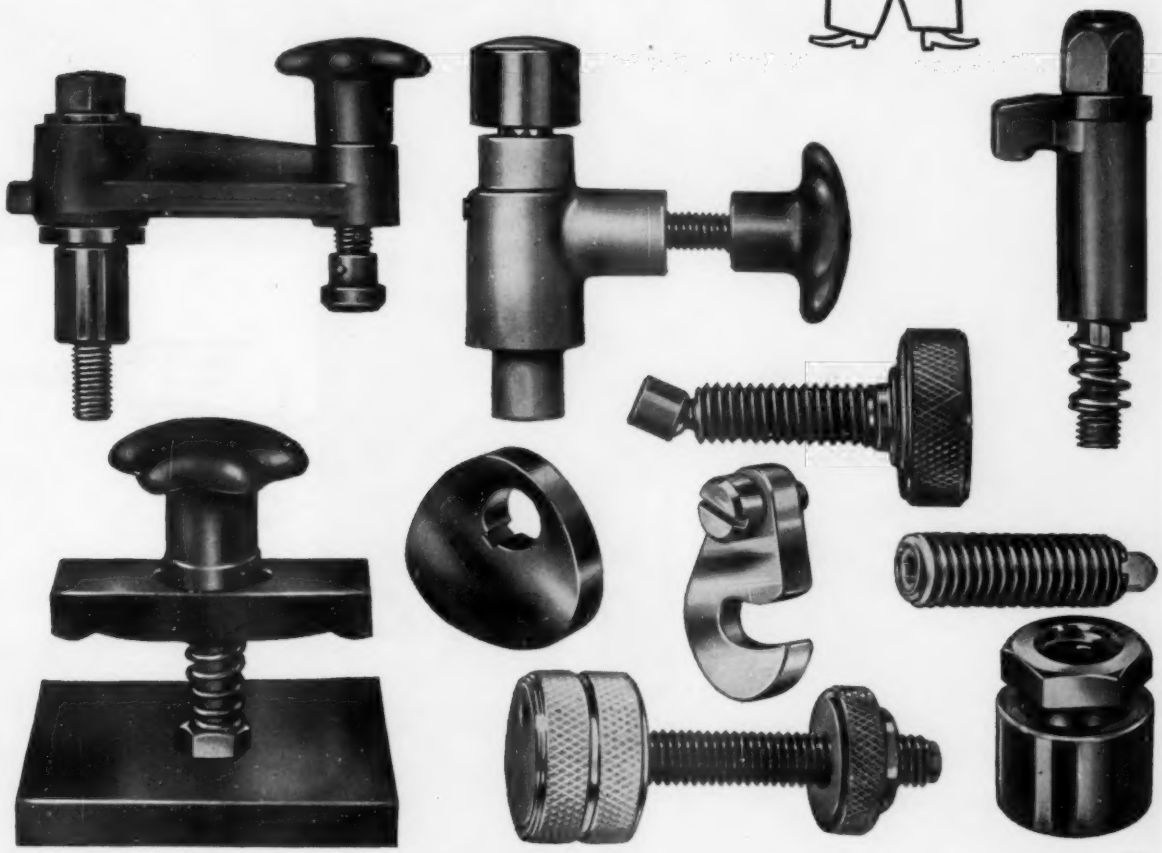


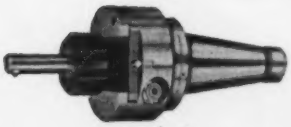
213

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck

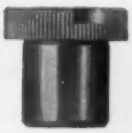
Standard Collet Chuck

Mikro-Lok Boring Bar

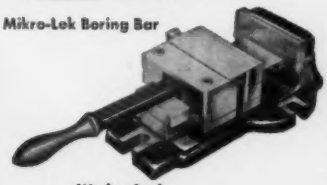


Boring Chuck

"Kwik-Switch" Tool Holder



Standard Drill Bushing

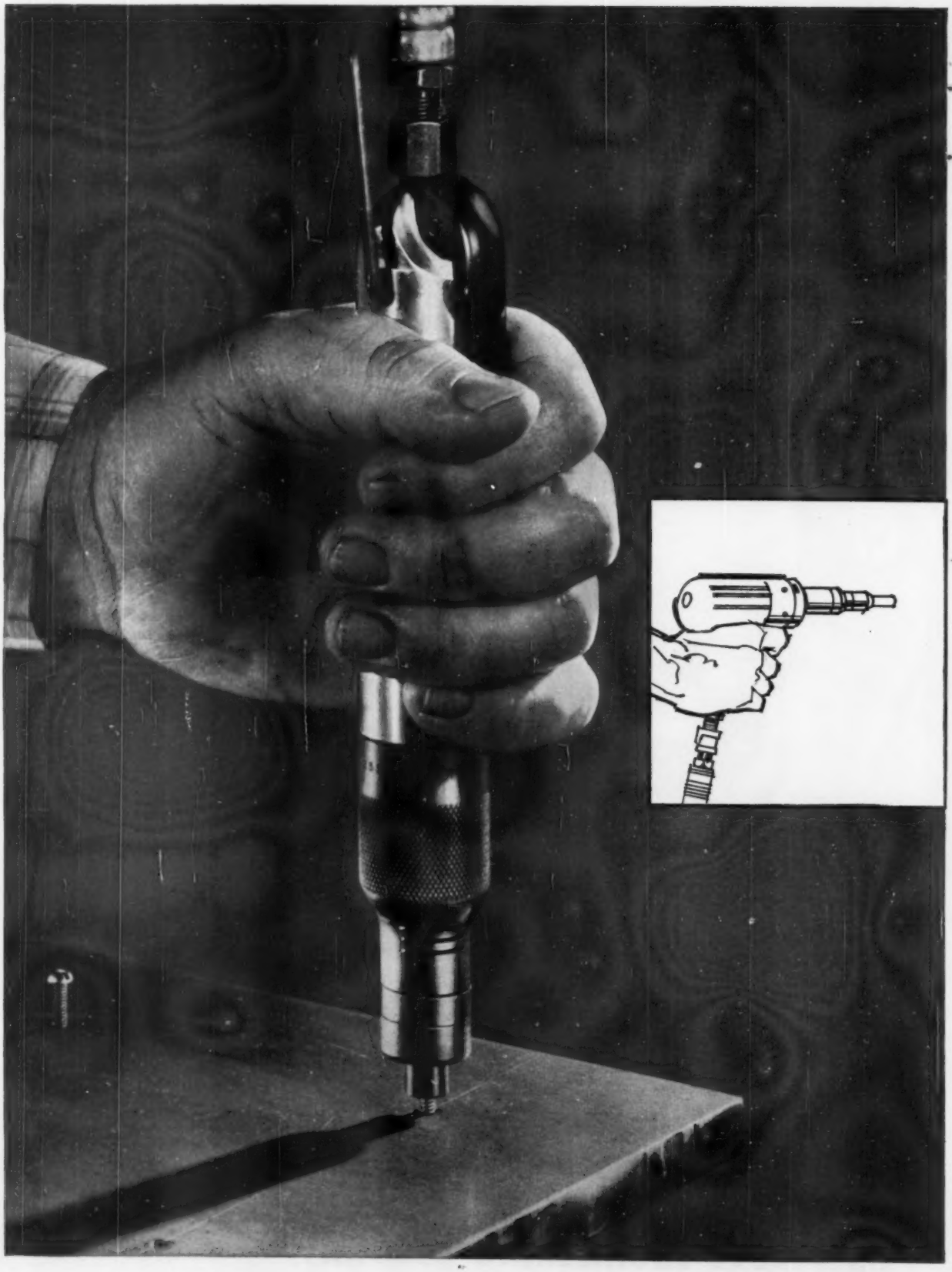


Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 4, MICHIGAN

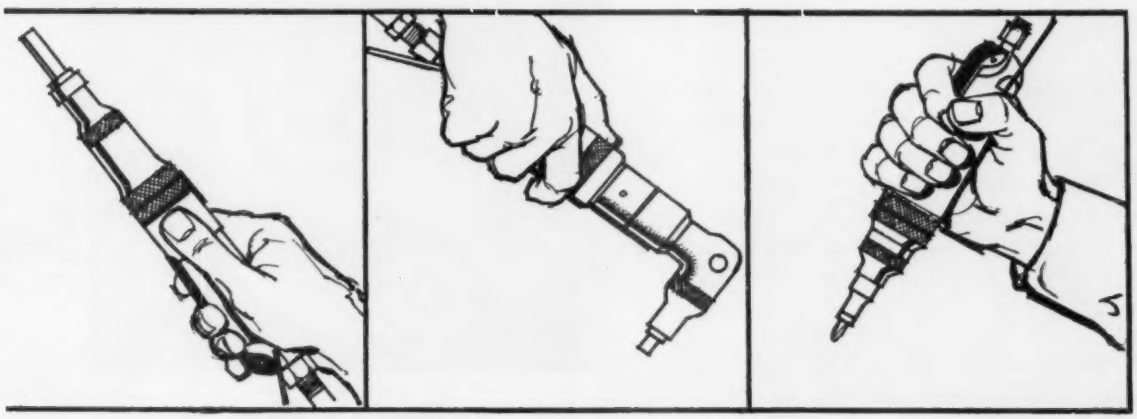
Use Reader Service Card, CIRCLE 50

Use Reader Service Card, CIRCLE 51



for screwdriving . . .

Make these hands more productive with the right air tools



From watches to automobiles—for screwdriving, or any production fastening job, Gardner-Denver has the right air tool to keep expensive hands working at top efficiency. Attachments to drive all types, all sizes of fasteners provide hundreds of uses for the basic air motor. Assures complete versatility and interchangeability so vital to ever-changing production methods. For details, see your Gardner-Denver air tool specialist or write for Section 12 bulletin.

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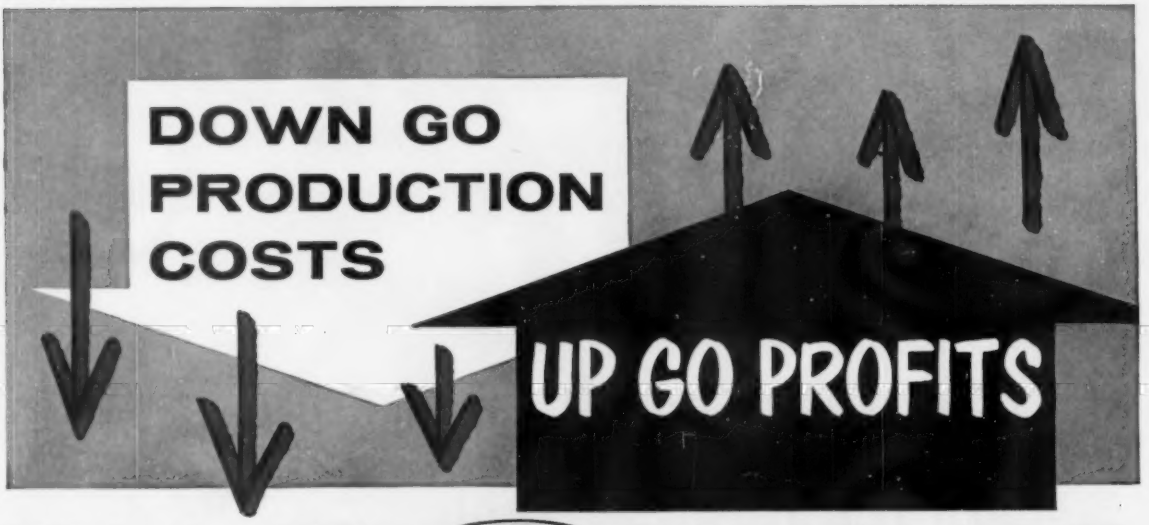
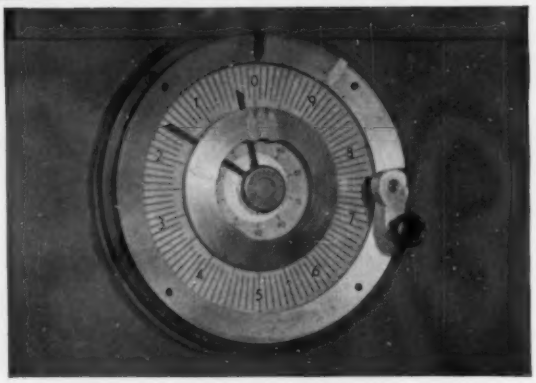
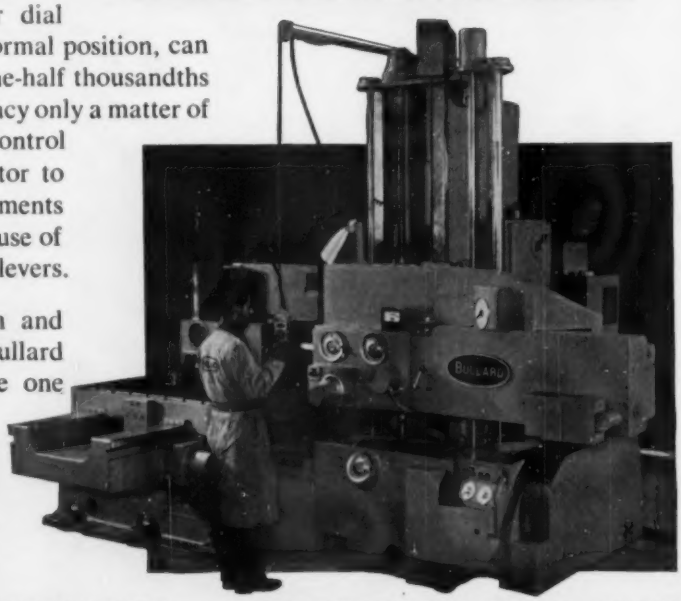


With the NEW BULLARD DYNAMILL H.B.M.



The controls, which have made it possible for Dynamill to reduce non-productive positioning time to a minimum, feature variable traverse rates recorded on large, clock-type dials, and controlled by Bullard's remote control pendant.

Head, table, saddle, and spindle each have a separate three-pointer dial which the operator, from his normal position, can easily read to an accuracy of one-half thousandths of an inch with further accuracy only a matter of simple interpolation. The remote control pendant allows the operator to traverse and position all elements under power without the use of handwheels, cranks or levers.

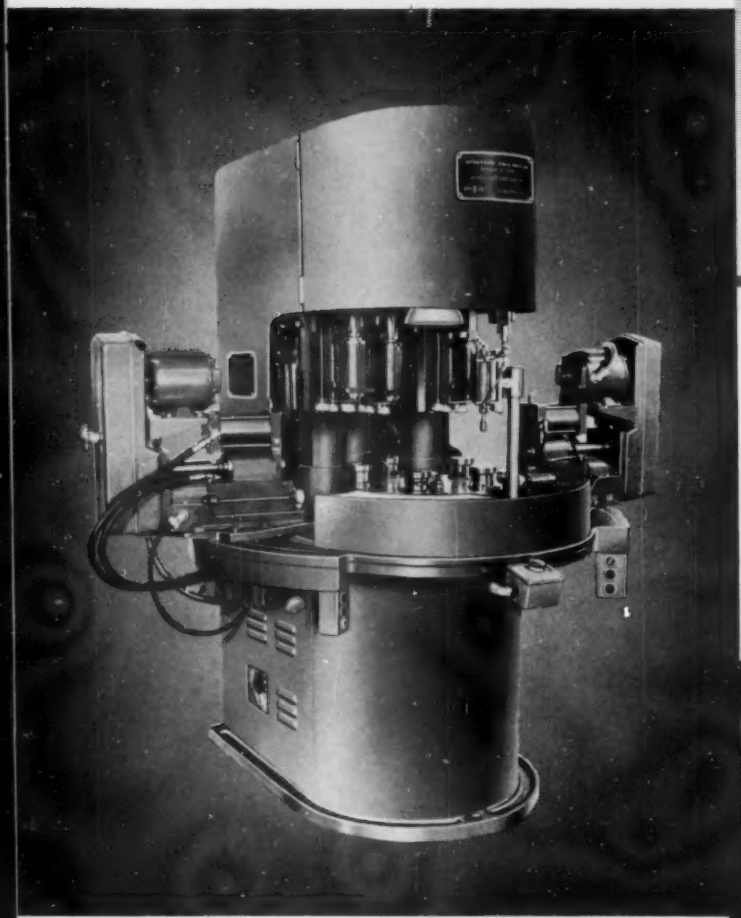


These and many other design and construction features of the Bullard Dynamill H.B.M. make it the one machine you

must investigate before buying any horizontal boring machine.

THE BULLARD COMPANY **BRIDGEPORT 9, CONN.**

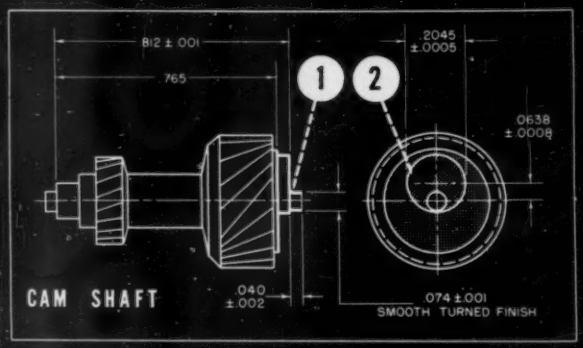
Another Case History From Standard Tool



STANDARD TOOL'S *NEW* 2nd Operation Machine

says **Bill Iversen**
at **Bell & Howell Co.**

"Never before has a machine tool investment paid off so fast. This new machine, in addition to proving itself on our eccentric cam shaft, is so easy to set-up that it now handles an entire group of second operation work. Our methods department is still finding new jobs to process thus increasing its usefulness in our continual cost reduction program. This Standard Tool machine has conclusively established itself as one of the most profitable pieces of equipment we have ever installed."



PROBLEM:
To reduce the high cost of producing one of our precision eccentric cam shafts which required over 2 minutes of hand screw machine time to chuck and turn the eccentric.

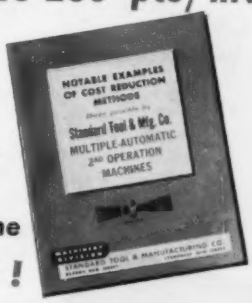
OPERATIONS PERFORMED
① Turn to .074" ± .001 dia. and face to .812" dim.
② Eccentric turn .2045"±.0005 and face to .765" dim.

New precision machine tool performs multiple secondary operations simultaneously at 286 pcs/hr.

● With the *Standard Tool* automatic chucker, Bell & Howell's actual production time for this turning operation was reduced 90%.

Find out how the *Standard Tool* automatic chucking machine can help you realize savings too. Please send your part prints and allow our methods engineers to prove conclusively the savings you can realize. We will be pleased to demonstrate the machine's ease of set-up, versatility, accuracy, and cost reduction ability.

This Free Book details 30 typical cost-saving examples using Standard Tool 2nd Operation Machine



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The VLIER new product BULLETIN BOARD

Brief descriptions of new VLIER products available now from your VLIER distributor!

NEW! Swivel Pad Torque Thumb Screws

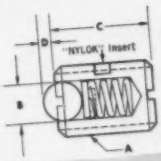
The perfect holding tool—combines torque-limiting feature of Vlier Torque Thumb Screws and the surface-protecting pad of Vlier Swivel Pad Clamps. Exclusive ball-joint construction. Available as standards in four sizes.

ITEM NO.	A	B	C	D	END PRESSURE IN POUNDS
TS-103	¼-20	2⅛	3/16	3/8	12-14
TS-103-A	5/16-18	2⅛	3/16	3/8	14-16
TS-104	3/8-16	2¼	3/16	3/8	16-18
TS-107	½-13	3	½	1⅛	18-20

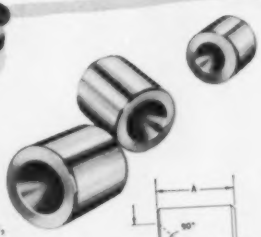
National Coarse Thread Series Class #2A fit.

NEW! All Stainless Steel Ball Plungers

Available as standards in 10 sizes from 4-48 x 3/16" to 5/8-11 x 1"; standard end pressures. Special sizes and end pressures also available.



NEW! Hardened Ball Buttons

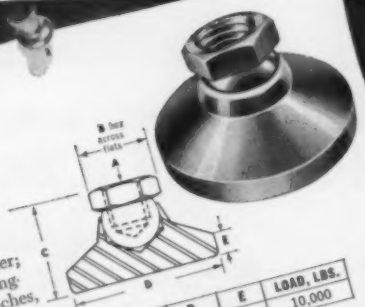


The perfect, ready-made, easy-to-install detent for use with Vlier Ball Plungers. Available in eight sizes.

ITEM NO.	FOR VLIER BALL PLUNGER NO.	A	B +.0002 −.0000
BB-46	B-46, B-47	1/8	.1075
BB-48	B-48	1/8	.1175
BB-50	B-50, B-52, BL-52, BH-52	5/16	.1614
BB-54	B-54, BL-54, BH-54	1/4	.2034
BB-56	B-56, BL-56, BH-56	5/16	.2659
BB-58	B-58, BL-58, BH-58	3/8	.3284
BB-60	B-60, BL-60, BH-60	1/2	.4378
BB-62	B-62, BL-62, BH-62	5/8	.5472

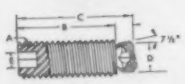
NEW! Leveling Pad

2½" in diameter; ideal for leveling machines, benches, electronic racks, etc.



ITEM NO.	A	B	C	D	E	LOAD, LBS.
P308B	5/8-11UNG-2B	7/8	1¼	2½	5/16	10,000

NEW! A Miniature Socket-Set Swivel Pad Clamp... only 10-32 x ½"!



ITEM NO.	A	B	C	D	E	LOAD, LBS.
SC-324	Class 2 fit 10-32	11/32	½	.146	Hex 3/32	500

ask your distributor for complete information TODAY!

Economy of New Machines

One of the biggest problems facing management today is how to justify the acquisition of the new machines, tools and the many other new things that have resulted from the research and development by manufacturing industries and the government. For instance, our works manager wanted to buy two new automatic machines but, on the basis of the formulas provided by the machine tool industry, the new machines would not pay out until about eight years. We made the decision to buy the machines even though they did not seem to be a sound investment in view of the rapid technological changes occurring in the machine tool industry.

The problem of amortization we faced is similar to the problem faced by others throughout manufacturing industry. Therefore, one of the greatest services that could be performed by ASTME would be to establish research projects at institutions where studies of new developments could be conducted on modern computers. Answers would tell management with assurance if practical and profitable utilization of specific developments is possible.

We are also of the opinion that such information and service would be a boon to the machine tool industry and to all of the allied manufacturers of tools, materials, inspection equipment, conveying equipment and other accessories essential to the most efficient manufacturing setups.

From my travels and visits to many manufacturing enterprises, I believe that many technological advances are not being utilized by American industry. If we are to maintain our position as a leader in the industrial world, it is of utmost importance that no time be lost in the utilization of the most efficient manufacturing equipment and processes available.

I suggest we work out a method to help management justify the purchase and use of the latest technological developments in the manufacturing field.

Dale Long

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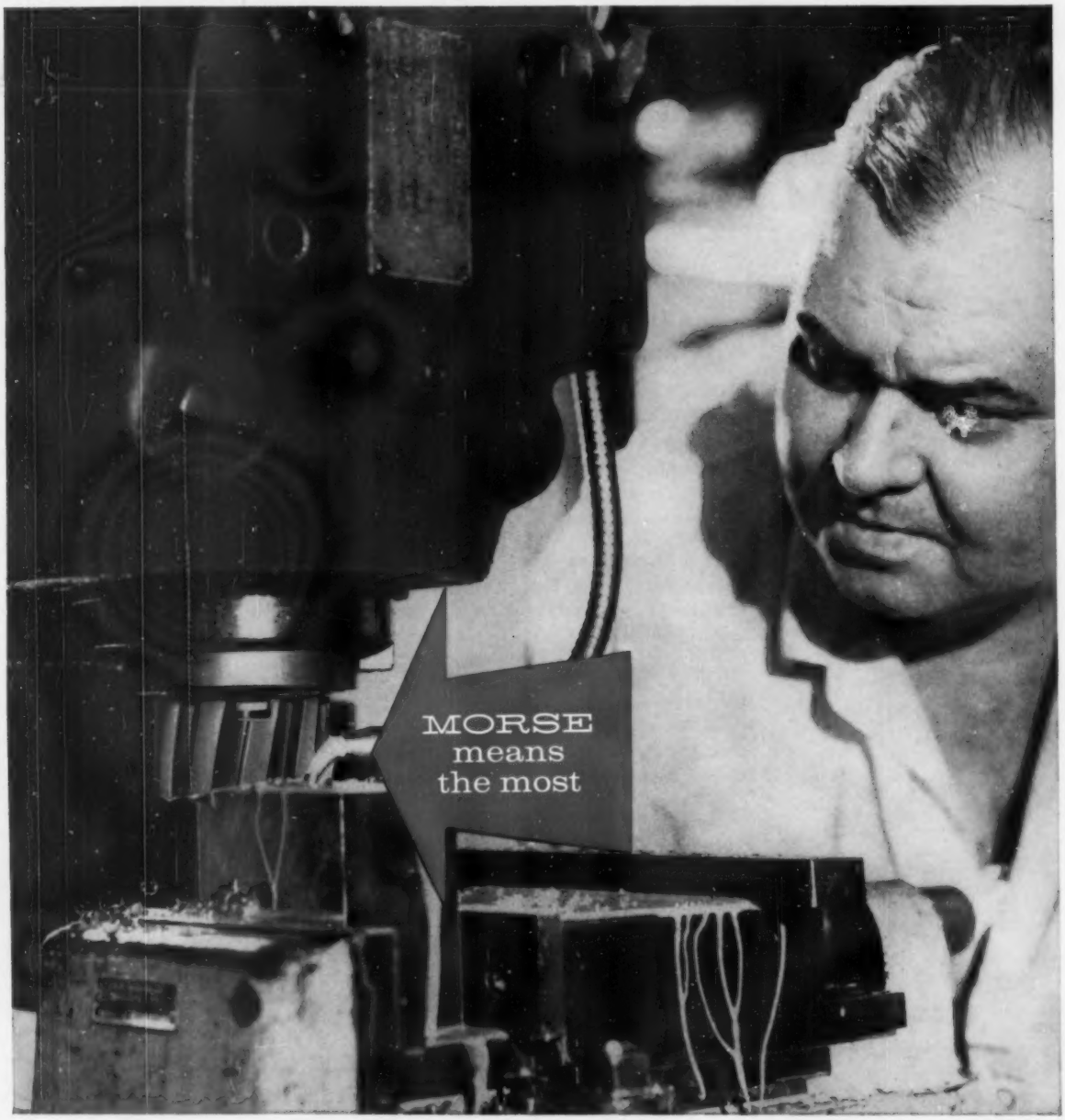

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the essential TRIANGLE

• scientist
• engineer
• engineering technician

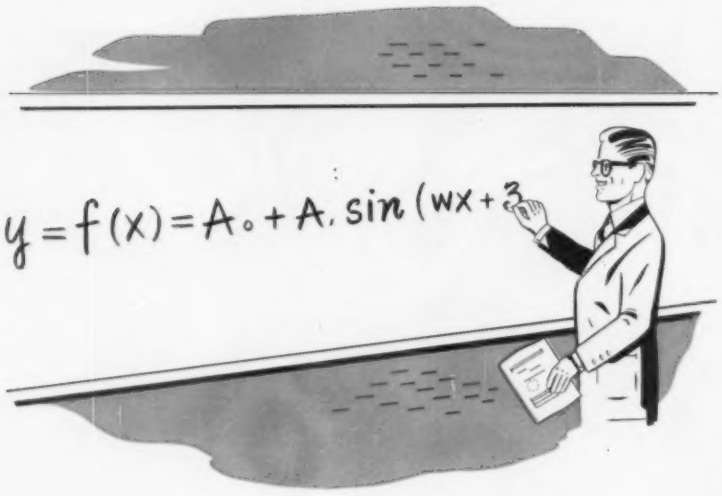
By O. S. Hulley

The scientist, the engineer and the engineering technician form an essential triangle that brings projects such as space rockets to a successful conclusion.

The boundaries between the work of the scientist, the engineer and the engineering technician are not sharply defined. Each makes important contributions toward America's industrial and economic progress.

TECHNOLOGICAL and industrial progress depends on the scientist, the engineer and the engineering technician—an essential triangle. Each makes major contributions to progress; each depends upon the contributions of the others. The engineer depends upon the scientist for new knowledge. And the engineer depends on the engineering technician for specialized assistance in translating engineering plans into operating reality.

The boundaries between the work of the scientist, the engineer and the engineering technician—if any such boundaries exist—often overlap. Their role is established by the type of work they do—the types of jobs they tackle and their approaches to those jobs—rather than by their titles. With this



The scientist deals with the world of fundamental natural law; he is not ordinarily interested in specific practical everyday problems.

in mind, it is interesting to ask:

- Where do the *pure scientist* and the *engineering scientist* fit into tool and manufacturing engineering?
- How can true professional engineering work in tool and manufacturing engineering be identified?
- What is the basic responsibility of the engineering technician in tool and manufacturing engineering?

These questions cannot be answered without taking close look at the work—and attitudes—of the individual members of the "essential triangle."

The pure scientist makes his contribution to progress through the investigation of the unknown. He seeks new knowledge of physical phenomena through research. This research is conducted for the sake of knowledge; the scientist, as a scientist, is not usually concerned with whether or not his findings have immediate practical value. And the scientist measures results in terms of increased knowledge—increased understanding of the basic laws of the universe—rather than in terms of immediate application or monetary gain. Obviously, however, the discoveries of the scientist often have great practical value.

The interests of the engineering scientist are in the area of applied, rather than purely theoretical, science and research. He seeks to abstract engineering knowledge from the findings of the scientist —to develop new engineering principles and to prove the engineering feasibility of new concepts, although not necessarily their economic practicability.

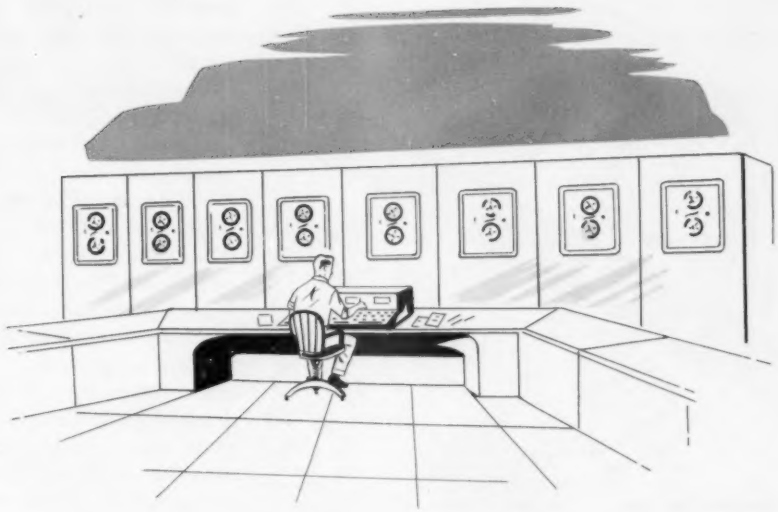
Working in what is, for the most part, a highly theoretical world, the engineering scientist is disciplined to analyze and think in abstract terms. He resolves most problems into "inputs" which, through "formulations" (a mathematical term), he resolves into "outputs"—an answer in abstract terms.

Since mathematics is the most definite and abstract language available, it is one of the principal tools of the engineering scientist. The electronic computer, which enables the engineering scientist to literally crowd many man-months of computation into a few seconds, has contributed to the growth of engineering science.

Scientists work in a world of generalizations and abstractions. The engineering technician, on the other hand, works in the "real" world of specific things and concrete objects. His problems are practical and they require practical solutions. He is primarily interested in how to do things. He understands engineering tables and formulas and applies them in his work constantly.

What Do You Think?

As Chairman of the ASTME National Education Committee, the author has the responsibility of determining the educational needs of tool and manufacturing engineers and engineering technicians, then developing programs that serve those needs. As a first step, he has defined the terms "engineer" and "engineering technician." He emphasizes that these definitions are tentative and invites reader comment on the subject of his article and on engineering and technical training problems in industry.



The engineering scientist works with generalized engineering problems, applying the basic findings of the pure scientist to these problems. Electronic computers have greatly aided his work.

The scientist, the engineering scientist, the technician—all play an important role in the modern world. Where does the engineer fit into the picture?

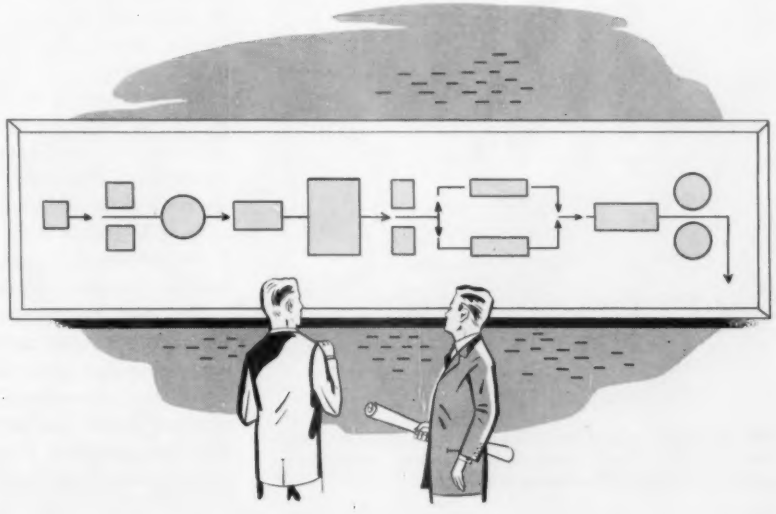
To start with, the engineer must cut a swath across all three areas of activity. Engineering work can be divided into four steps:

- Defining or identifying specific problems or problem areas
- Translating these problems into abstract inputs
- Making formulations to determine abstract outputs
- Translating these outputs into practical solutions.

The principal work of the engineer is design. He designs products, machinery, production systems. His interest is not so much in the acquisition of new fundamental knowledge as in the effective and economical use of the findings of the scientist and the developments of the engineering scientist. His over-all objective is service to society through the application of engineering principles.

Where the engineering scientist is concerned with technical feasibility, the engineer is concerned with practicability in the economic sense. Like the engineering scientist, the engineer asks "why?". Like the engineering technician, he is also concerned with "how?"

The engineer must combine many of the characteristics of the scientist, engineering scientist and engineering technician. He must have a basic konwledge of the sciences, and understanding of—and ability to use—the abstract techniques of the engineering scientist and he should know much of the technology employed by technicians.



The engineer is concerned with specific, practical problems—the design of a machine or a production system for example.

Engineering cuts a swath across the areas of science and practice, linking science and technology.

Perhaps the most important function of the engineer, so far as industrial and technological progress is concerned, is to integrate the work of the essential triangle—to quarterback the team.

The engineer must be a scholar—creative, studious and a self-starter. His interest must be in bridging the gap between the abstract-theoretical world and the technical-practical world.

How do the various members of the scientific and industrial progress team fit into the field of tool and manufacturing engineering?

Both the pure scientist and the engineering scientist are needed for pure and applied research in the tool and manufacturing engineering area. Projects such as those sponsored by the ASTME Research Fund and numerous research projects at colleges and universities, and in industry itself, depend on the abilities of scientists and engineering scientists. And, certainly, tool and manufacturing engineers and technicians are needed in abundance for the continued progress of American industry.

The engineering technician applies data developed by the engineer to the solution of practical production problems in manufacturing plants.

The difference between an engineer and a technician is the manner in which the job at hand is performed. A practical solution to a specific plant layout problem, for example, can be developed using a group of models or templates, a floor plan, some pins and colored string, and some basic dimensional rules as to work area, aisle widths and so on. This, however, is not engineering.

An engineering solution to a typical plant layout problem—determining the amount of storage space required adjacent to a given machine—would involve determining hourly machine output and available in-plant transportation. Then these factors could be quantified and, through queuing theory, a specific answer could be derived.

It should be pointed out that not all of the problems encountered by the engineer in his practical world are this simple. In a production situation there is seldom time or money to determine all the facts that bear on a problem. The variables in manufacturing problems are many. For this reason, many practical problems are solved on the basis of experience. The solutions to problems solved in this way may be satisfactory, but they are incomplete.

Incidentally, the observations that can be made of the work of the engineering technician—his practical solutions to production problems—can provide a vast source of ideas for scientists and engineers. The technician often works out good solutions to those problems but doesn't know why they work. The scientist and engineer, by analyzing those empirical solutions, can develop general laws or principles that can be applied to solving similar problems.

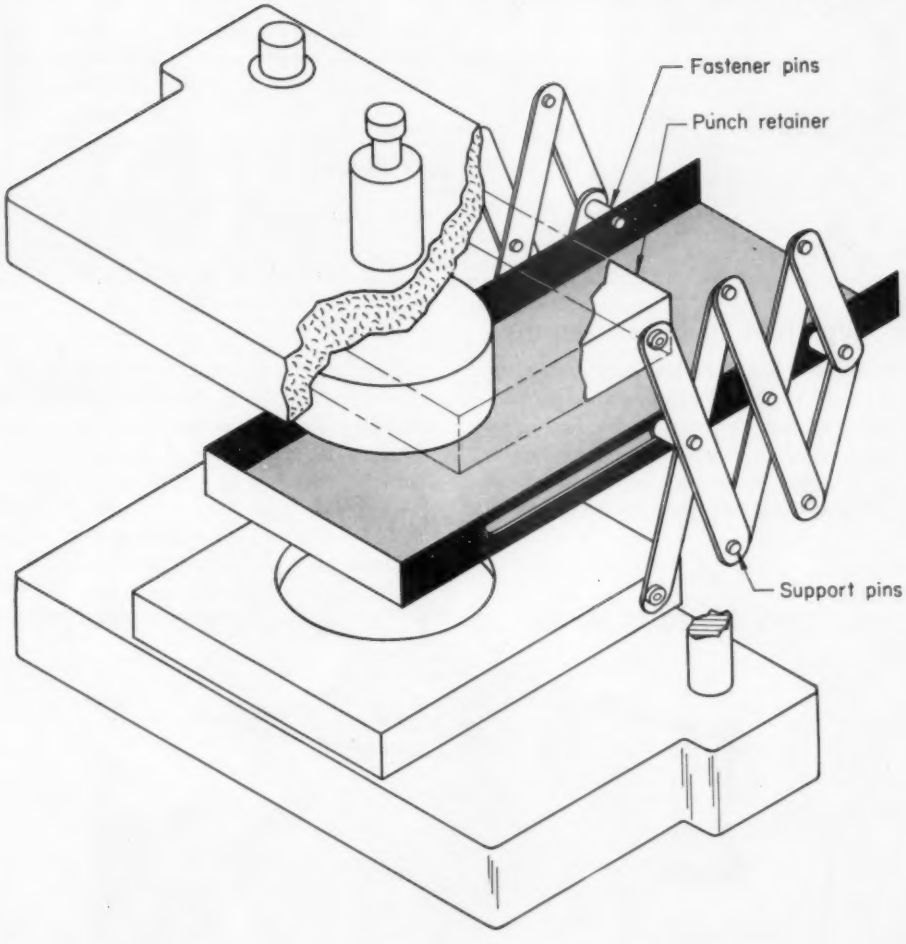
An engineering solution to a problem—as contrasted to an empirical, "cut-and-try" solution—involves making an analysis of the problem that can be applied wherever a similar problem occurs in the future.

Another way of solving production problems is to rely on reference tables and the like. To determine the feeds and speeds for a specific machining operation, for example, a technician may rely exclusively on handbook data. This is not engineering—the real engineer for this job is the man who developed the data presented in the feed-and-speed tables.

This does not minimize the importance of the engineering technician. By helping the engineer to put engineering plans into action, he makes a real contribution. He is as important a member of the team as the scientist and the engineer. Each member of the essential triangle is needed if American industrial and economic progress is to be continued.

Gadgets

Ingenious Devices And Ideas



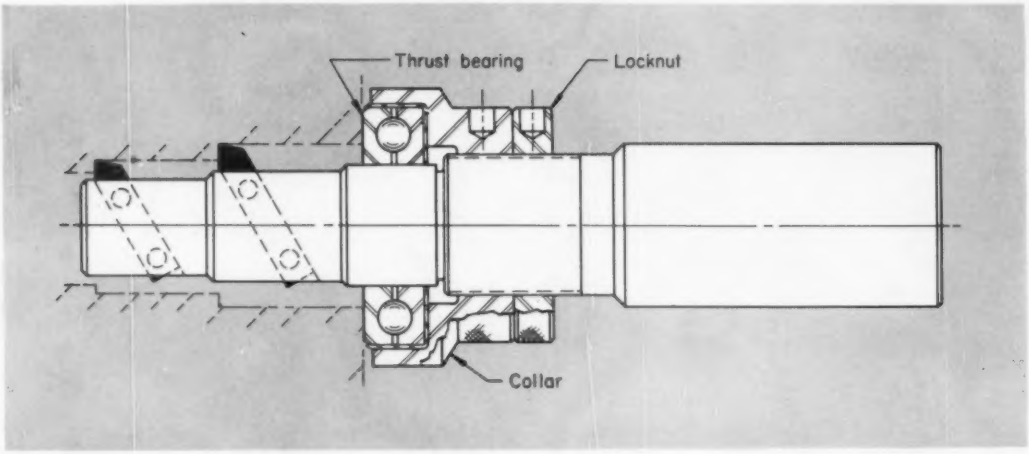
Sliding Tray Removes Stamped Parts

Part removal from a stamping die at the moment of part ejection is accomplished by the tray shown in this drawing. Tray movement to and from the dies is effected by a scissor-type linkage system.

As the dies close, two fastener pins by which the tray is attached to the linkage system move away from the die. During die closure, support pins—moving at a relatively slower rate of speed than the fastener pins—travel in an elongated slot. Use of the four pins keeps the tray in a level position.

Clint McLaughlin
New York, N. Y.

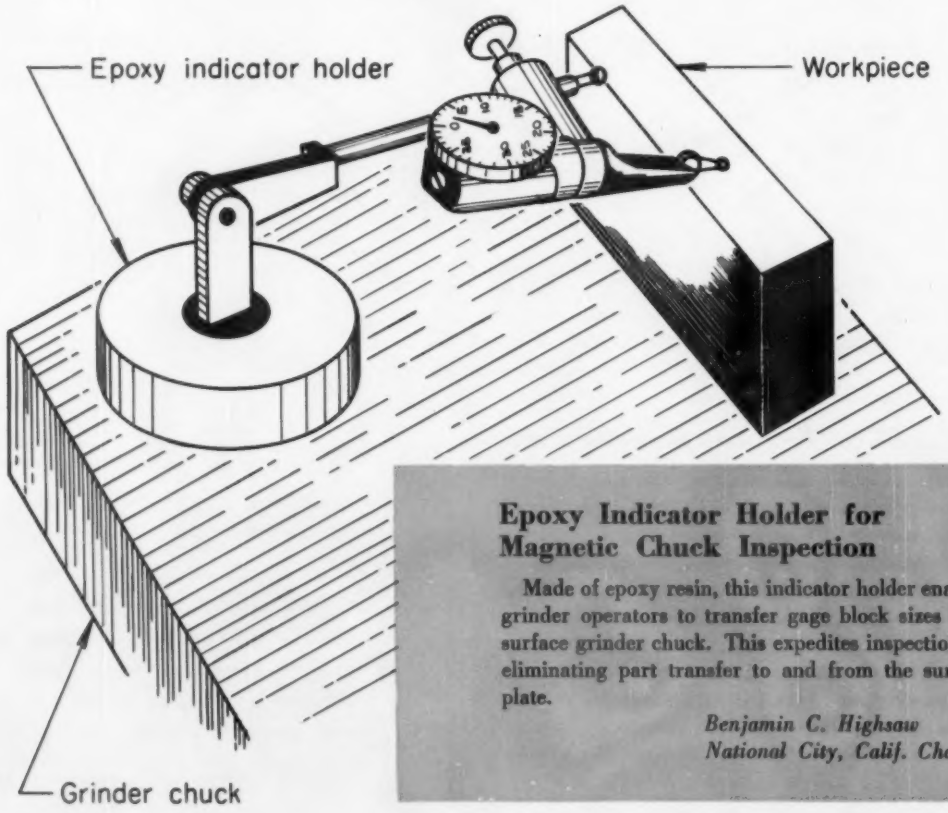
Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Honorariums for accepted articles are sent upon publication.



Lathe Stop Hold Precision Depths

Counterbored to hold a thrust bearing, this lathe stop is designed to hold dimensions to close tolerances during boring. Screwed on the boring bar shank and secured by a locknut, the stop can be accurately adjusted to control the depth of cut. Required depth is obtained when the thrust bearing contacts the machined face of the workpiece. Use of this stop eliminates the need for accurate workpiece chucking and lathe-saddle stops.

Roger Isetts
Kenosha, Wis.



Epoxy Indicator Holder for Magnetic Chuck Inspection

Made of epoxy resin, this indicator holder enables grinder operators to transfer gage block sizes to a surface grinder chuck. This expedites inspection by eliminating part transfer to and from the surface plate.

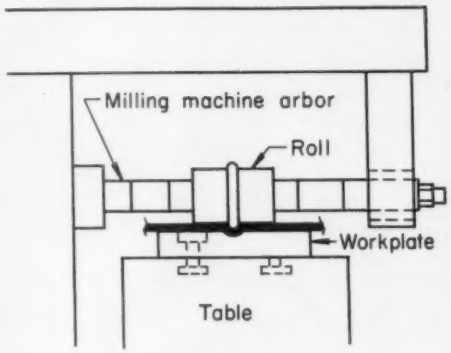
Benjamin C. Highsaw
National City, Calif. Chapter

Roll Machines Stiffening Beads

Stiffening beads on prototype parts can be formed in setups of this type. Two components, a roll mounted on a milling-machine arbor and a notched workplate, are required.

In operation, the roll should rotate at the slowest possible speed. The table—operated manually—is moved at a speed as close as possible to that of the roll. Grease or heavy lubricants should be used to prevent galling.

Lester Comstock
Kalamazoo, Mich. Chapter

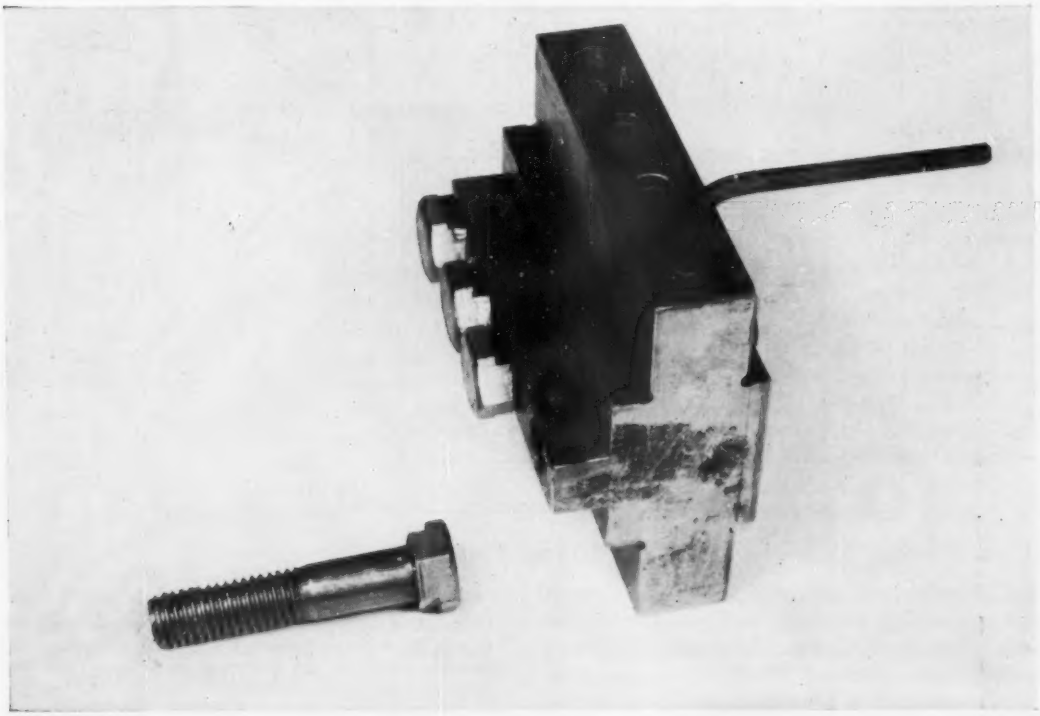


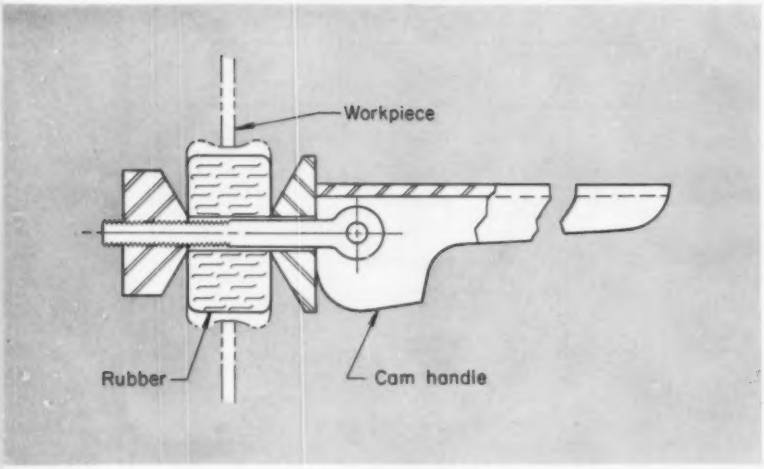
Vise Fixture Simplifies T-Bolt Milling

T-bolts, always in demand for machining operations, are inexpensively produced from standard hex-head bolts in this milling fixture. Only two machining cuts are necessary—one on each side of the fixture. Because the locating surfaces which position the fixture are symmetrical on either side of center, no correction in milling-cutter height is necessary when the fixture is reversed.

During machining, the bolts are held in position by set-screw pressure. To prevent galling, the pressure is exerted against soft plugs which bear against the shanks of the bolts.

H. J. Gerber
Member-at-Large
Stillwater, Okla.

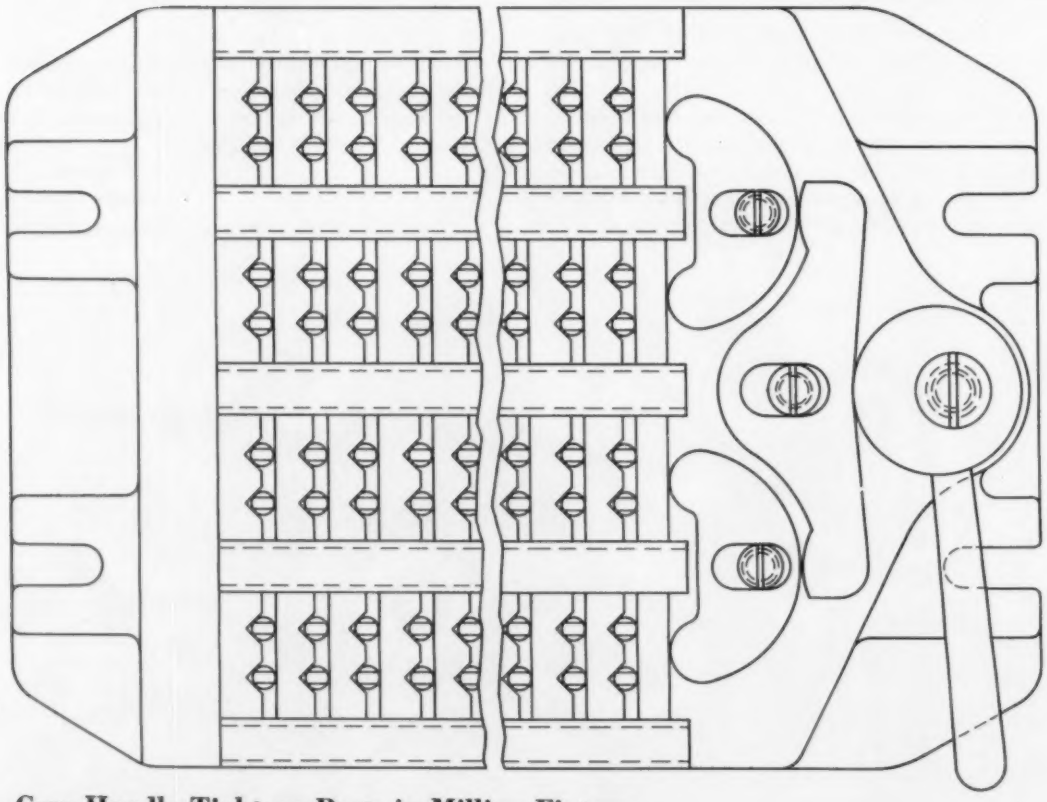




Sealing Device

Holes in hollow vessels can be sealed for pressure testing or to exclude chips during machining operations with this device. Utilizing standard cam handle, the tool functions by compression of a rubber spacer between two washers. Compression is effected by movement of the handle. Spacers of various diameters can be made to suit a variety of hole sizes.

Donald A. Bruno
Racine, Wis. Chapter



Cam Handle Tightens Parts in Milling Fixture

Positioning and locking of 96 cylindrical parts for gang milling is accomplished by tightening one cam handle in this fixture. Four rows of V-blocks —each row containing 12 individual two-place blocks—are used to hold the parts. Action of the cam handle against a master clamp causes individual bell clamps to tighten the V-blocks against the work.

Hjalmar Dahl
Upplands Vasby, Sweden

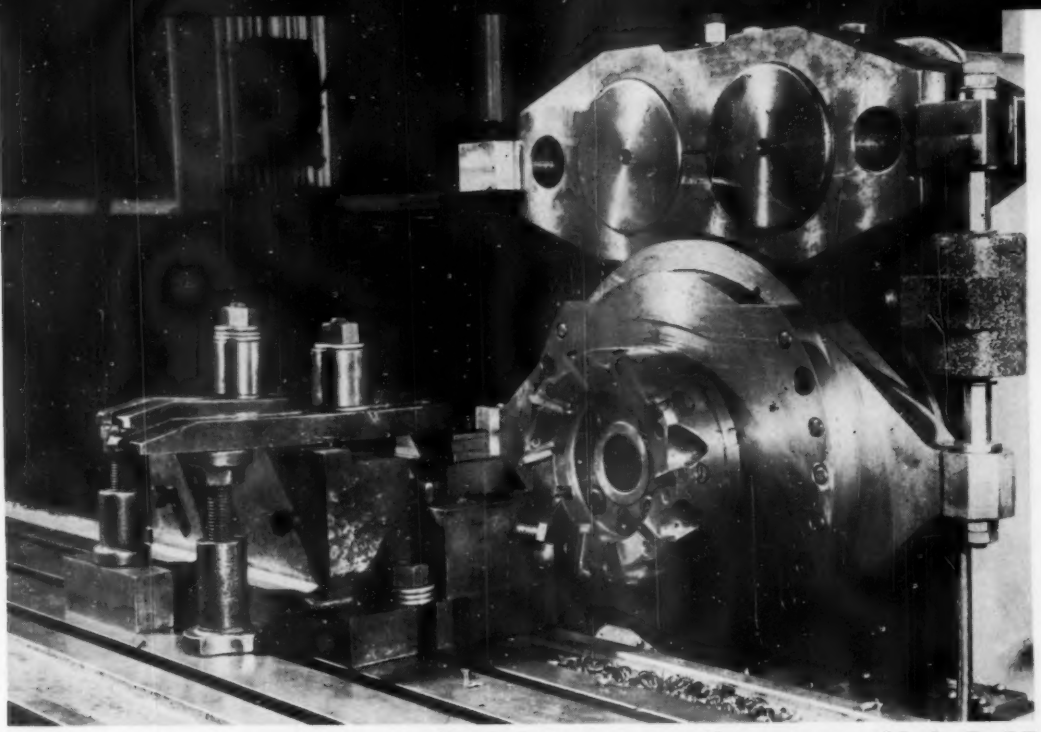


Fig. 1. Cutting test setup with torquemeter and load cell. Cell is rigidly attached to reaction member on machine overarms.

measuring forces in MILLING

By **A. O. Schmidt**, Chief Engineer
J. R. Roubik, Senior Research Engineer
G. Hug, Research Engineer
Kearney & Trecker Corp.
Milwaukee, Wis.

By using a planetary torquemeter, it is possible to measure tangential cutting force with a high degree of accuracy. With these force measurements, values of related qualities such as cutting torque, work or energy, and power can be obtained. The efficiency of a machine under various conditions can also be determined without difficulty.

From a paper presented at the ASTME Seminar "Metalcutting Today." A limited number of single copies of the complete paper are available without charge from Society Headquarters. A bibliography appears with the complete paper.

FOR EXPERIMENTAL RESEARCH in milling, it is desirable to have a device capable of measuring tangential cutting force with a high degree of accuracy and sensitivity over a broad range of laboratory and shop conditions, with single-point and multiple-point milling cutters of various sizes and geometries. With such force measurements, it is a simple matter to obtain values of related qualities—cutting torque, work or energy, and power—which prevail at the cutter. Also, if power input to the machine is measured simultaneously, machine efficiency under various conditions can be determined.

Most cutting force data have been gathered in continuous turning operations, with the feed or uncut chip thickness constant. Although all metalcutting operations have much in common, some important differences exist. Milling and similar operations are inherently of an interrupted or intermittent nature. The workpiece is engaged by an individual cutting edge during only a part of each

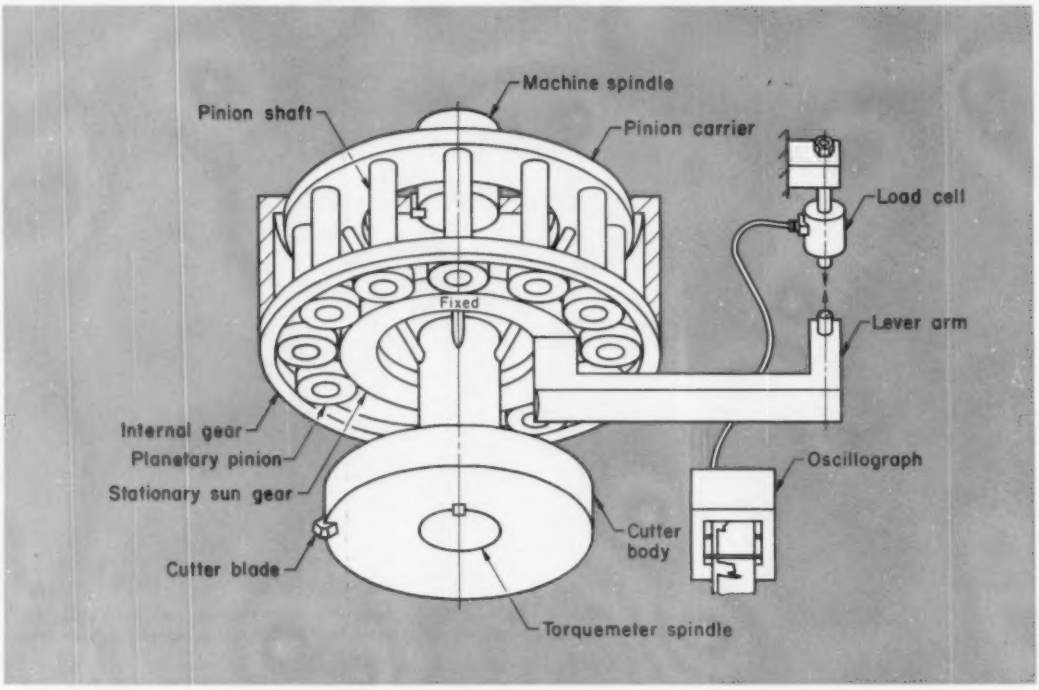


Fig. 2. Schematic diagram of planetary-gear milling torquemeter. All rotational axes are horizontal.

revolution, resulting in a chip of varying, rather than constant, thickness from point to point along its length. This, together with the entry and exit of successive cutting edges, causes the cutting load in milling to oscillate, rather than to be relatively constant as in turning operations.

Thorough and accurate efficiency measurements with a prony-brake load on the spindle of a particular milling machine have sometimes been made. The relative steadiness of a brake or noncutting load, however, is not as good a simulation of the oscillating-load characteristic of the milling process as might be desired. Milling-force values obtained indirectly from electrical and prony-brake tests are, at best, approximate, average values only.

Dynamometer: For direct and accurate measurement of instantaneous and average values of the tangential cutting effort in full-scale milling cuts and determination of machine efficiencies under actual cutting loads, a dynamometer or torquemeter of planetary gear design has certain advantages. In a planetary-gear milling dynamometer, *Fig.* 1, the gearing transmits force or torque through an element in the train that is stationary (and thus does no work) to a load-sensing device, while simultane-

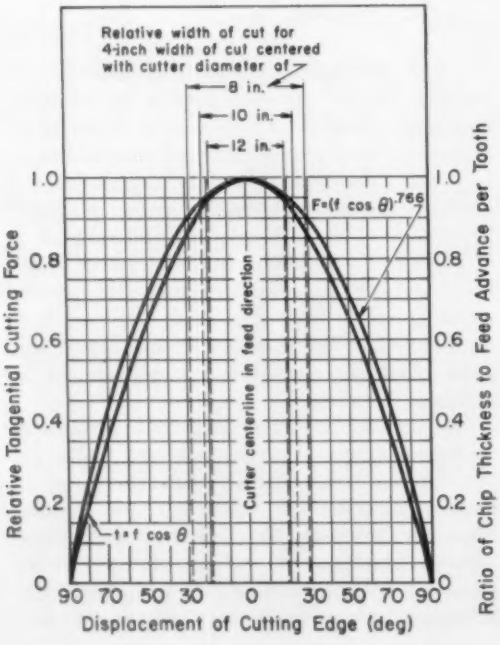


Fig. 3. Variation in uncut chip thickness and tangential cutting force in 180-deg milling arc of a single tooth. Curve $t = f \cos \theta$ represents ratio of chip thickness to feed advance per tooth at various positions of the tooth in its cutting arc. If force were directly proportional to feed, this curve would also represent the variation in force. Cutting force, however, is not always proportional to chip thickness and is represented by the curve $F = (f \cos \theta)^{0.766}$

ously driving a cutter with little transmission loss. One advantage of a planetary torquemeter is that it provides a rather direct means of evaluating rotating forces without the need of rotating force-sensing elements or pickups. Another advantage is that it can be readily mounted on different milling machines, thus permitting comparative efficiency tests.

As can be seen in *Fig.* 2, a torque is transmitted from the machine spindle, through planetary gearing to a milling cutter and also to a fixed element in the gearing where it can be measured with a load cell. For the right-hand cut and position of the load cell shown, the cell is in tension. A universal amplifier and direct-writing oscillograph—or an oscilloscope—record the load-cell voltage output. This output is proportional, depending on the various lever arms, to the tangential tooth loads at the sun-planet gear mesh and also at the ring-planet gear mesh, to the tangential loads on the pinion shafts and to the tangential force on the cutting blade.

When mounted on a milling-machine spindle, the torquemeter has a spindle-nose peripheral eccentricity or runout pattern resulting from an accumulation of slight eccentricities in the machine spindle, mounting counterbore, tapered roller bearings and mountings, and in the torquemeter spindle itself. It is difficult and expensive to reduce this runout much below 0.0005 inch.

A Baldwin SR-4 load cell, Type U-1, 2000-lb capacity, serves as a pickup to measure the reaction force on the stationary lever arm of the torquemeter. Tensile loading of the cell is preferred.

To record force data with a high degree of linear response in the range between 0 (dc) and 100 cps, the output of the load cell is fed through a Brush BL-350 input box to a BL-520 universal amplifier coupled to a BL-254 oscillograph. To record force traces with a faithful high-frequency response, the load-cell output is fed to a Hughes 104-D storage type oscilloscope, which retains transients on its screen. These transients can be photographed.

When oscillograph and oscilloscope records of the same force pulse are compared, the average value and general shape of the pulse are similar on both charts but the amplitude and frequency of vibration are greater in the oscilloscope trace. Fluctuations superposed on the basic pulse form are partly caused by the gearing (as is the case with any sensitive tool dynamometer used on a gear-driven machine tool) and partly by the basic process of chip formation. The two causes are probably closely interrelated.

Force Measurements: If t, the uncut chip thickness at the milling cutter centerline (in the direction of feed) is assigned a relative value of unity, then, as a first approximation generally involving only a small error, the uncut chip thickness at any point in the arc of travel of the cutting edge through the workpiece is

$$t = f \cos \theta$$

where f is the feed advance per tooth (modified for corner angles other than 0 deg) and θ is the angular displacement of the cutting edge, measured from the cutter centerline parallel to the direction of feed.

Carbide milling tests on SAE 1018 cold-rolled steel indicate that the relative cutting force, F, depends on the relative feed per tooth or chip thickness as follows:

$$F = f^{0.786}$$

This relative cutting force has a value of unity when milling a chip having a relative thickness of unity. Thus the relative cutting force acting on the cutting edge at any instant during its arc of travel through the workpiece is very nearly

$$F = (f \cos \theta)^{0.786}$$

This relation is depicted in *Fig.* 3 for a milling tooth sweeping through a cutting arc of 180 deg

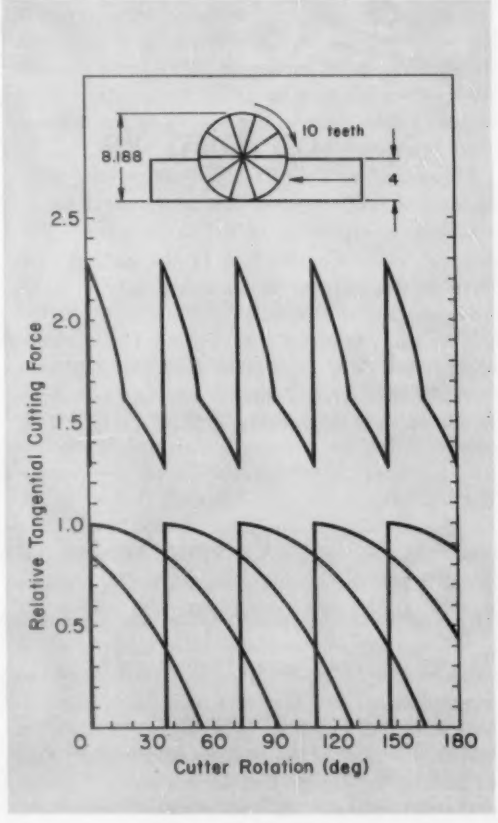


Fig. 4. Constructed tangential cutting-force curve for condition shown at top. Milling is performed with a multiple-tooth face mill.

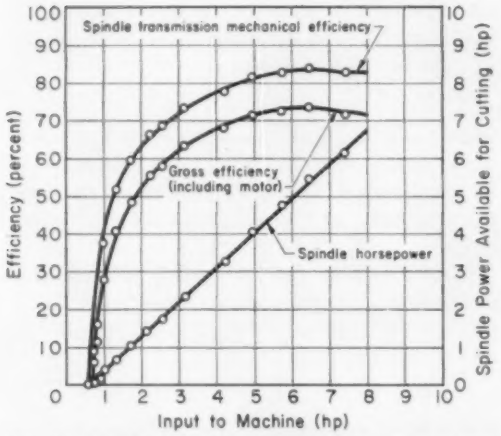


Fig. 5. Sample efficiency curves for milling-machine spindle transmission driven by a 5-hp motor. Torquemeter and electrical measurements taken under cutting loads at approximately 200-rpm machine spindle speed with an 8-inch, 16-tooth carbide (C-2) face mill on 192-Bhn cast iron at 17-ipm table feed and depths of cut ranging from 0.003 to 0.200 inch for widths of cut of approximately 3½ inches.

(width of cut is equal to cutter diameter). Depending on the position of the cutter with respect to the width of cut, the general shape of a normal cutting-force pulse, except for initial impact, should closely resemble an appropriate sector of the curve shown. Comparison with actual force traces shows good agreement.

The pulsations of cutting force acting on a multiple-toothed milling cutter can be obtained by appropriate superposition of the force pulses of individual teeth. Construction of the cutting force curve in this manner is illustrated in *Fig.* 4 for the conditions of an actual cut.

When unity is the value assigned to the maximum cutting force for a single-tooth pulse, the maximum, average and minimum relative cutting-force values in *Fig.* 4 are, respectively, 2.27, 1.71 and 1.30. With a relative cutting force of 1.00 being equivalent to 520 lb, as determined in separate tests under similar cutting conditions, the maximum, average and minimum cutting force values indicated theoretically by *Fig.* 4 are 1180, 889 and 676 lb, respectively. These values compare to actual average measured force values of 1187, 897 and 746 lb.

Appropriate superposition of the force pulses for single teeth provides a wave form that satisfactorily indicates the actual magnitude and manner of pulsation of the cutting force with multiple-tooth cutters. Magnitudes of successive force pulsations will generally be different because of effective cutter runout, which is always present to a greater or lesser degree in milling operations.

Machine Efficiency: Over-all machine efficiency can be determined by taking simultaneous cutting force and electrical power input measurements during cuts with multiple-tooth cutters. Output or cutting power can be derived from the cutting-force record and input power to the machine can be determined with a calibrated motor. Machine efficiencies determined in this manner are shown in *Fig.* 5. To expedite machine-efficiency measurements, the output of the load cell or input to the universal amplifier can be integrated by an appropriate integrating resistance-capacitance network to obtain a recorded average cutting force, rather than a sawtooth or irregular force trace, which requires several time-consuming planimeter measurements of the area under the trace to obtain an accurate value of the average cutting force.

Research with instruments of the kind described is only one aspect of the efforts being made by industry to obtain a better understanding of metal cutting operations and the behavior of machine tools under working conditions. These research efforts should lead, ultimately, to greater metalcutting efficiency and a substantial reduction in America's machining bill.

Ceramic Tooling: Answer to Sealing Riddle

Glass-to-metal seal manufacturers are faced with an enigma: the only available mold material which resists wetting by molten glass at 1000 C is carbon or graphite. These materials are, however, relatively soft and unable to hold tolerances. Another limitation is that, in the oxidizing atmosphere used for sealing, the carbon deteriorates rapidly. Finally, the carbon creates its own reducing atmosphere, robbing oxide from the metal header cups and impairing the ability of the glass to wet the metal.

Duramic—a high temperature ceramic tooling material produced by Duramic Products, Inc.—solves the problem in one of two ways. One way is by designing the mold cavities so that there is no contact between the glass and the Duramic. The other is by using carbon inserts in those portions of the Duramic mold in contact with molten glass. The ceramic tooling material does not oxidize as does carbon or graphite and, unlike Inconel or stainless steel tooling, it does not pick up oxide or change size. Increased leakproof yield and decreased tooling costs result.

Fig. 1. Operator punches keys indicating storage location to which the load of parts will be sent. Nearest retriever (foreground) is about to unload a tray of parts selected from the smaller module unit.

Storing and Retrieving Stock

—mechanized system fetches and carries

By Robert Heslen
Associate Editor

By dividing storage space into equal sized space modules and giving each module a distinct location address, a mechanized stock picker can store or retrieve anything in the storage area. Efficient utilization of space, speed, and nearly infallible storage and retrieval of stock characterize operation of the system.

CONFLICTING DEMANDS—the desire for the economies of long-run production opposing the necessity of short-run assembly and delivery—beset many industries. The opposing demands are often reconciled by setting up a storage area to act as a buffer between the two, thus gaining the economies of long-run production and making it compatible with delivery schedules. This method has been used with success by a plumbing fittings plant of American Standard. Parts are produced economically in large runs and removed to the storage area in tote trays and bins. For a given assembly, a set of part tickets is used by a stock picker to pull the parts required for the assembly run. The complete collection of parts is moved into a staging area, and from there fed into appropriate stations in the assembly line. Parts are fed from the staging area into the assembly stations in quantities sufficient to keep the line running without cluttering the assembly area.

Mechanized Storage: Increases in production and an expanded product line put a double strain on the in-process storage operation—more kinds of parts to keep track of and greater amounts of them. As a result of the increasing strain on the operation, gas-driven lifts and hoists were busy, stock pickers were rushed, and bins occasionally had to

be stacked too high. On some days, in-process storage was the scene of hectic activity. To add to the confusion, parts sometimes became "lost" and could not be found, idling an assembly line that needed just one particular item. This increased pressure on the storage operation and made the job even more difficult. Sometimes an assembly line had to be switched over to a different assembly, only to find the "lost" part had merely been misplaced. Sometimes also, a "lost" part was rerun in the machining department and it was afterward

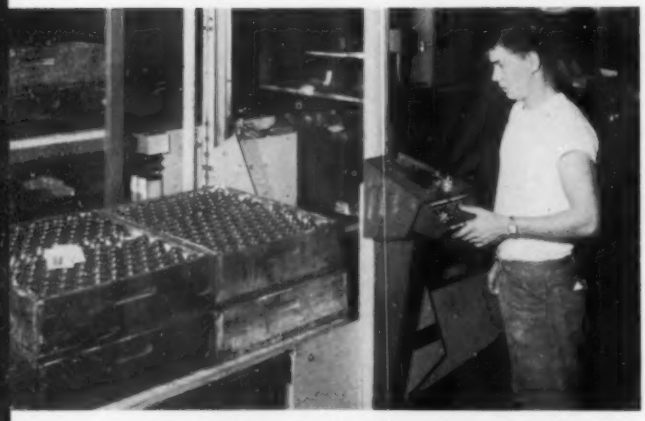


Fig. 2. Tray of parts is loaded from platform into retriever system by operator's command to the storage system, placed via the console.

discovered that the missing part actually existed in sufficient quantity.

Because storage space could not be expanded, improvement of the operation demanded more efficient use of the available cube of space. But any cube can contain only so much. The cube cannot be stacked solid. Space must be allowed for access, for hoisters and work-lift trucks to move in, maneuver and retrieve the desired item. Reducing access space is the method used by the retriever, *Fig.* 1, to raise the efficiency of space utilization. The retriever needs three inches on each side of the plywood tray for maneuvering. Thus, the aisleways (nonstorage area in the storage cube) are at a minimum. What previously required about 8000 feet of floor space to store is now stored in 4000 or 5000 sq ft of floor space.

Storage space on each side of the aisleway is divided into space modules. For the largest of two Triax units shown in *Fig.* 1, 658 storage spaces are arranged in 7 levels and 47 bays along each side of the 130-foot aisleway. Each of the space modules can stow a cube 30 x 45 x 18 inches. The smaller module arranges 528 modules in 33 bays, 8-high on each side of a 90-foot aisleway. Its storage cube is 30 x 24 x 15 inches. Each space module has a unique address, indicated by a set of digits such as 3274, the address for the material in bay 32, 7 levels high, bank 4 (left side of aisle 2).

To store or retrieve items, the operator sets up the address on the command console as shown in *Fig.* 1. To store parts in space 3274 for instance, the retriever is commanded as shown in *Fig.* 2. Upon receiving the store command, the retriever reaches under the load-unload platform, gently raises the plywood tray and contents, and moves them back to a position centered on the aisle. The retriever then trolleys down to bay 32, up to level 7 and slides its load leftward into the addressed space and returns for its next command. To retrieve items from storage, the process is accomplished in the reverse fashion.

Storage Gains: In addition to space savings, experience with mechanized storage reveals other important gains. To set up a given assembly in the staging area, the operator now works from a set of part tickets containing the Triax address of each part. He commands the retriever to fetch the required component and sets up the staging area in roughly 25 percent of the time previously required. Storing parts received from machining departments is accomplished with similar dispatch. Stock is now accessible, accounted for and identifiable. Auditors preparing inventory on the contents of in-process storage can now maintain control over stored parts better than before, and with roughly 50 percent savings in time. Housekeeping in the storage area is improved. Gas-driven lifts and hoists are eliminated and with them, the danger from their exhausts. Costly product damage caused by stack-crushing is eliminated and there is less stress on stored parts and no box breakage or spilling.

Possibly the most important result of mechanized storage is that a trouble spot has been eliminated. Removal of the difficulties associated with in-process storage has incited a movement toward improving material handling generally. Tote boxes are being standardarized and studies of storage-to-assembly conveyors have begun.

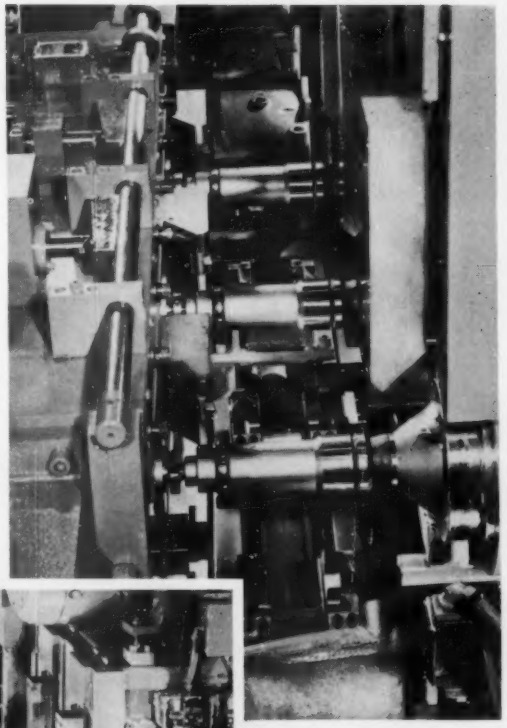
"Somebody stepped on the tape with golf shoes on."

designed for
PRODUCTION

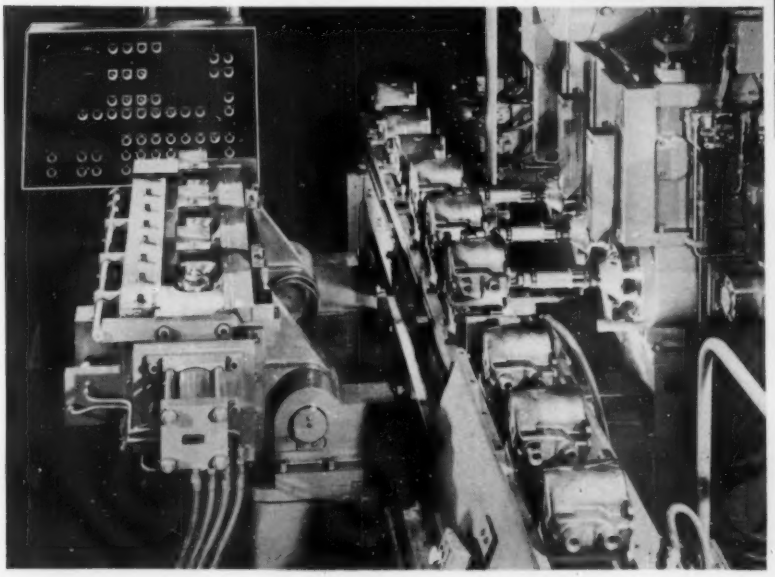
Machine Orients Parts After Machining

Transmission cases—manually loaded in one radial position—are picked up on expanding mandrels, faced and unloaded in a second position in this Cross Co. Transfer-matic. In operation the parts are loaded with their shifter-rod holes down and their cover faces to the left. Advancing to the machining area, they stop in positions opposite the mandrels. The mandrels then move forward through the bore and expand before contacting the tailstock centers. The transport bars are then retracted and machining begins.

After machining cuts have been completed, an unusual spindle-positioning device orients the parts with their cover faces down. This is accomplished by a slow reversal of mandrel rotation. When the part arrives at its proper unload position, a dog drops into place, locking the spindle. Return of the transfer bar releases the parts and indexing completes the machining cycle.



MANDRELS (above) in load position without parts. Locating pin for positioning work station is visible directly below the headstock spindle.



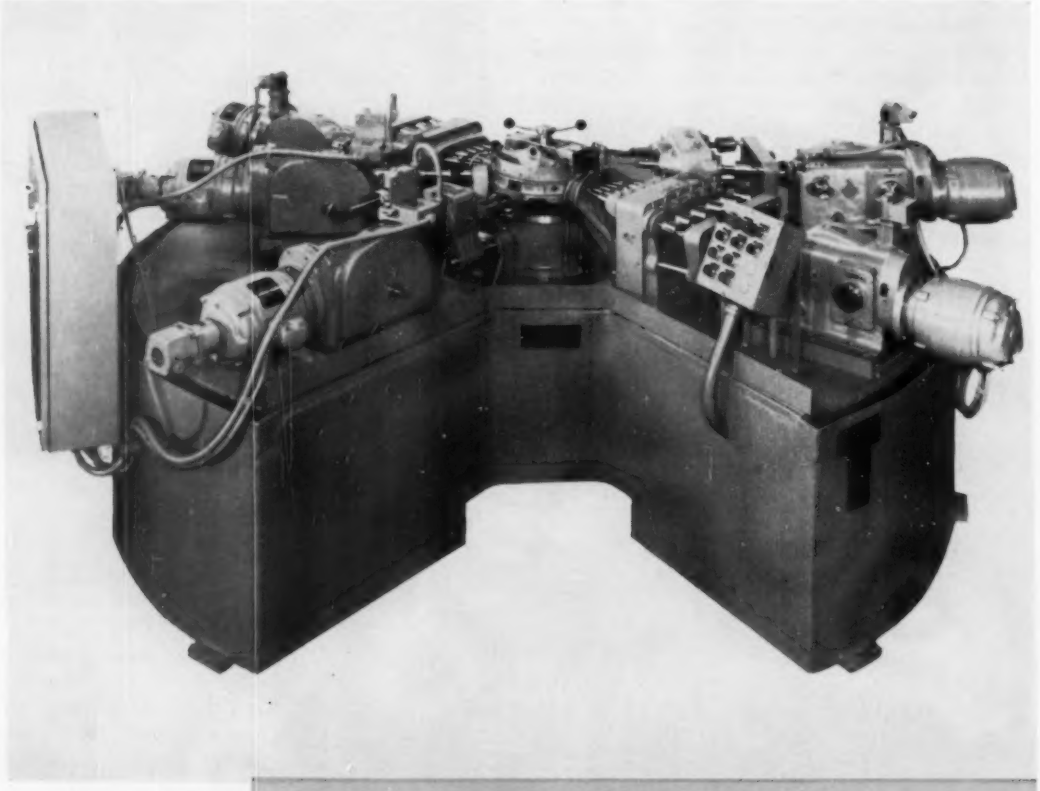
MACHINE in retracted position. Head at left is tilted back for access to tooling area.

Special Heads Drill Radial Holes

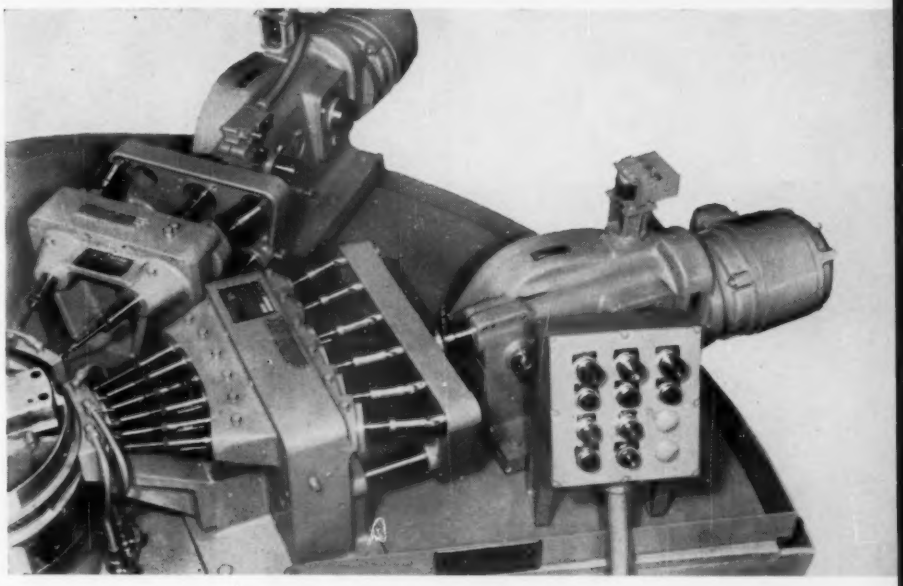
Designed to machine holes in circular missile components, this machine makes use of three drill heads in which the spindles are mounted in angular positions. A fourth head mounts conventional parallel spindles. All heads are products of the United States Drill Head Co.

The out-of-parallel spindles—designed so the drills converge toward a common center—are rotated by special gearing in the head. The gearing, in turn, is powered by a splined driver running from an Edlund cam feed unit.

Forward advance of the spindles is accomplished by a pusher plate attached to a flange quill on the power unit. Universal joints linking the spindles to the plate enable the drills to move toward the center of radius of the circular component being machined.

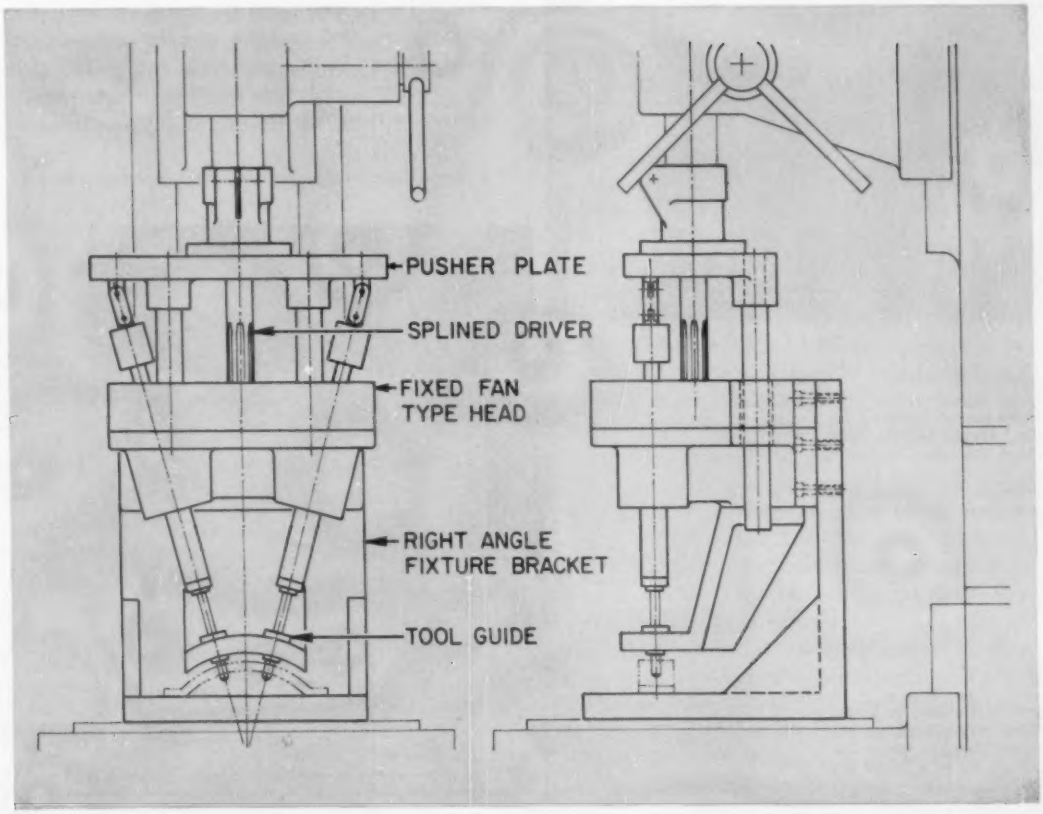


DRILLING MACHINE set up for operation. Recessed area in foreground permits easy access to machining area.



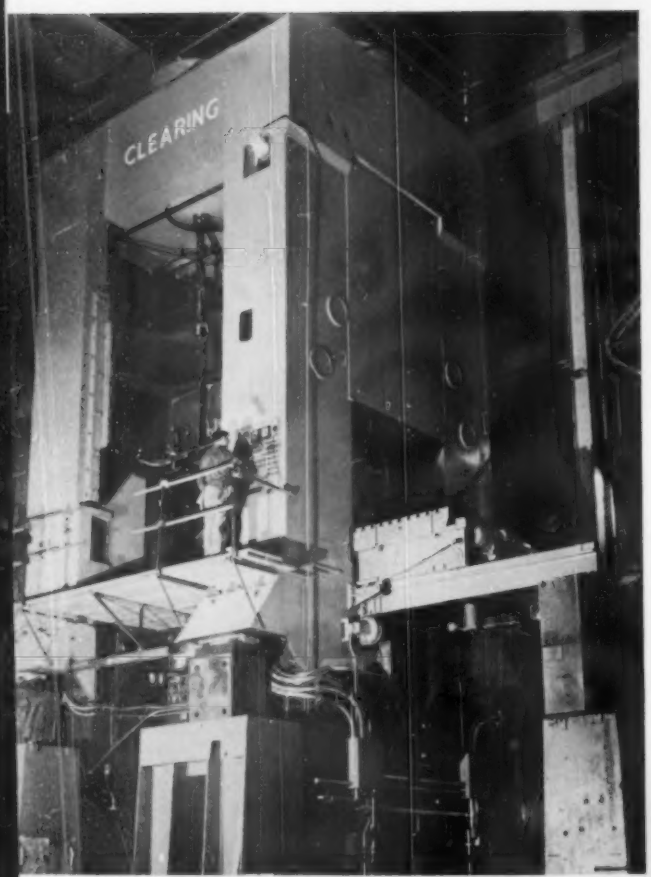
TWO OF THE FOUR special heads. Head at upper left shows spline which activates the gearing.

DIAGRAM of drill head components. Guide pins extending from pusher plate through drill head stabilize the drilling operation.



DESIGNED FOR PRODUCTION

Underdrive Press Operates at Two Levels

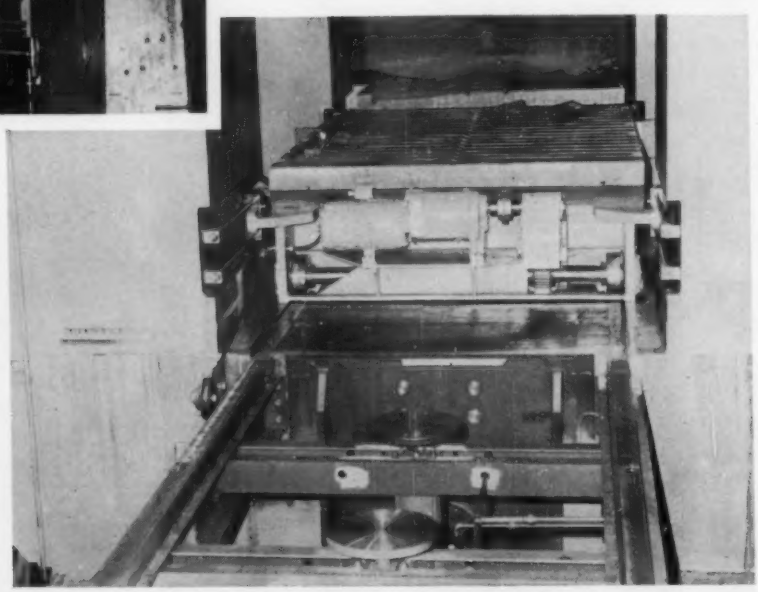


Significant advances in pressworking technology are seen in the Clearing press illustrated. Designed and built for the Isuzo Motor Co. of Japan, this press design incorporates improvements such as hydraulic locking devices, overload protection, die-space lighting, moving bolsters for fast die change, and a two-speed clutch.

Principal benefit of the two-speed clutch is the change of speed it provides during draw operations. Initial movement of the ram as it descends to position the draw ring is relatively fast. Subsequent motion of the inner ram is slower to allow plastic flow of metal to be established.

Presses of this design have an effect on other factors such as plant layout. For example this press—normally considered a pit type—is set up on the lowest plant level. The working area is on the next level. This integration of the press into the design of the plant itself provides two working areas instead of one. In this way scrap can be routed to the lower level while dies, stampings and production equipment remain at the second level.

PRESS set up (above) for final tryout before shipment to Japan. Platform on which operator is standing represents second floor level.



MOVING bolster in place. Electric motor and enclosed gearbox move the bolster to and from the working area.

how to get the most out of METALCUTTING

By Jens L. Wennberg
Senior Research Engineer
Physical Research Dept.
The Cincinnati Milling Machine Co.
Cincinnati, Ohio

After analyzing the cost of machining, the author presents formulas that, when applied to production machining jobs in any plant, will yield the proper cutting conditions for minimum costs.

CHIPMAKING COSTS—the costs of machining—may run as high as $20 billion annually in the United States. This astronomical figure can be substantially reduced if, in each plant, efforts are made to "get the most out of machining." One part of this effort is, of course, to study existing machining operations to see if improvements can be made.

Metal-Removal Costs: There are two types of metal-removal costs—productive costs and nonproductive costs. The productive costs are those incurred when actually removing metal. Nonproductive costs are incurred by setting up, loading, unloading, changing tools, preparing to make the cut and so on. Both types of costs greatly influence the economics of metal cutting.

From a paper presented at the ASTME Creative Manufacturing Seminar, "Metalcutting Today." A limited number of copies of the complete paper, which includes derivations for the formulas used, are available without charge from Society Headquarters.

Looking more closely at the productive cost (machining cost), it is apparent that it is equal to the time required for cutting, multiplied by the direct labor charge, plus the burden rate. The burden rate (or overhead charge) is the machine's share of the cost of depreciation, maintenance, factory space, and indirect labor such as crane operators and sweepers. This may be an average for the whole plant or it may be a specific charge for an individual machine. The productive cost is dependent on the cutting speed, since a higher speed will reduce the machining time per piece when the size of the cut is constant.

Going on to the nonproductive costs, the setup cost includes the labor and burden costs of mounting the cutter and the fixtures, and preparing the machine for operation. In some cases, the depreciation cost of the fixture is included. The setup cost is not dependent on the production rate, but is a flat figure of so many dollars per piece.

Loading, unloading and machine handling costs are incurred in loading the machine, rapid traverse to the position for cutting, starting the spindle, unloading and so on. Both labor and burden are included in this cost which, like the setup cost, is not dependent on the production rate (for a given machine) but is incurred for each part.

Tool costs are dependent on the production rate. When the cutting speed is increased, tool life is decreased, so tool costs increase. Two factors are involved in tool costs. The first of these is tool changing cost, which is determined from the tool changing time, including time to remove the tool, get a new tool from the toolroom, and place it in position. Both direct labor and burden charges must be taken into account. Tool changing cost applies only when no other operation can be performed while the tool is being changed. The other factor in tool cost is the cost of tool regrinding and depreciation. This is obtained from the time required to regrind the

Values of n for Machining Steel

Tool Material	n value	1/n	1/n - 1
High-speed steel	0.15	6.7	5.7
Cemented carbide	0.30	3.3	2.3
Cemented oxide	0.70	1.4	0.4

tool, the toolroom burden rate and the proportionate cost of the cutter. When grinding carbide cutters with special diamond wheels, the burden must be adjusted to account for this cost.

Cost per Piece: Cost per piece can be written:

$$C_p = C_m + C_s + C_l + C_t \quad \ldots\ldots(1)$$

where C_p is the cost per piece in dollars, C_m is machining cost per piece, C_s is the cost of setup per piece, C_l is piece loading cost and C_t is tooling cost per piece.

Machining cost, $C_m = T_m\ (L_m + B_m)$, where T_m is machining time per piece, L_m is direct labor rate and B_m is burden rate. Loading cost, $C_l = T_l\ (L_m + B_m)$, where T_l is loading time.

Tooling cost, C_t, can be expressed:

$$C_t = \frac{T_c\ (L_m + B_m) + T_g\ (L_g + B_g) + D_c}{N}$$

where T_c is tool-changing time, T_g is grinding time, L_g is grinding labor, B_g is grinding burden, D_c is the depreciation of the cutter per grind and N is the number of pieces per grind. Therefore:

$$C_p = T_m\ (L_m + B_m) + C_s + T_l\ (L_m + B_m) + \frac{T_c\ (L_m + B_m) + T_g\ (L_g + B_g) + D_c}{N} \quad \ldots\ldots(2)$$

The time to produce the part is given by the formula:

$$T_p = T_l + T_m + \frac{T_c}{N} \quad \ldots\ldots(3)$$

The machining time per piece, T_m, is equal to the length of cut, d, (inch) divided by the feed (inch per tooth), multiplied by the revolutions per minute and the number of teeth (one for turning); i.e.

$$T_m = \frac{d}{FRt} = \frac{d}{\frac{F\ (12V)\ t}{\pi\ D}} = \frac{\pi\ dD}{12\ FVt} \quad \ldots\ldots(4)$$

where V is the cutting speed (fpm) and D is the workpiece diameter in inches. It can be seen that the cutting speed is an important factor in machining time, and consequently in machining cost.

The number of pieces per tool grind, N, is also a function of cutting speed. It is defined as:

$$N = \frac{T}{T_m} \quad \ldots\ldots(5)$$

where T is the tool life from the Taylor Equation, the equation of the tool life-cutting speed curve. This is expressed as $VT^n = C$, or

$$T = \left(\frac{C}{V}\right)^{1/n} \quad \ldots\ldots(6)$$

Substituting this Equation and Equation 4 in Equation 5:

$$N = \frac{\left(\frac{C}{V}\right)^{1/n}}{\frac{\pi\ dD}{12\ FVt}} = \frac{12\ FtC^{\,1/n}}{\pi\ dDV^{\,1/n-1}} \quad \ldots\ldots(7)$$

It can be seen that the number of pieces per grind, N, decreases with an increase in cutting speed. This decrease increases tool costs.

Effects of Cutting Speed: There is a definite relationship between cutting speed and total cost. As shown in *Fig.* 1, there is a point of minimum cost at some optimum cutting speed where the decrease in machining cost is offset by the increase in tool cost.

The time per part—the reciprocal of the production rate—is shown as a function of cutting speed in *Fig.* 2. With an increase in cutting speed, the machining time decreases and the tool changing time increases to give an optimum value at some cutting speed. The cutting speed for lowest production time is always higher than the cutting speed for lowest cost.

Optimum Speed: The optimum tool life—and consequently the optimum cutting speed—can be determined for minimum cost and maximum production from formulas. For minimum cost:

$$T = (1/n - 1)\ \frac{T_c\ (L_m + B_m) + T_g\ (L_g + B_g) + D_c}{L_m + B_m} \quad \ldots\ldots(8)$$

$$V = \frac{C\ (L_m + B_m)}{(1/n - 1)\ T_c\ (L_m + B_m) + T_g\ (L_g + B_g) + D_c} \quad \ldots\ldots(9)$$

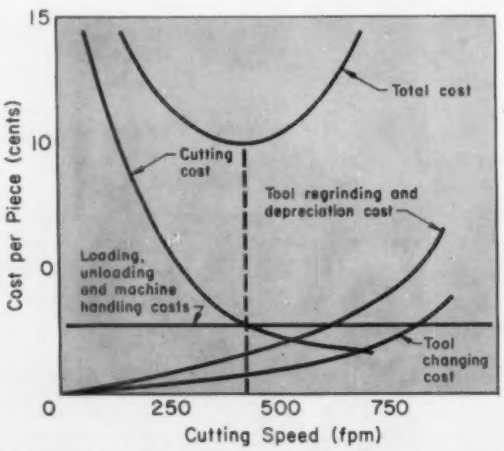


Fig. 1. Effect of cutting speed on cost per piece.

For maximum production:

$$T = (1/n - 1)\ T_c$$

$$V = \frac{C}{\left[(1/n - 1)\ T_c\right]^n} \quad \text{.....(10)}$$

Less computation is needed to obtain the optimum tool life, so this is the usual calculation made. In words, the optimum tool life for minimum cost is equal to a constant determined by the tool life curve times the tool changing cost plus the tool sharpening cost divided by the labor and burden cost. The optimum tool life for maximum production is equal to the constant determined from the Taylor Equation times the tool changing time.

The *n* Value: When tool life, obtained experimentally, is plotted against cutting speed on log-log graph paper, a straight line is produced. The equation of this straight line is $VT^n = C$, the Taylor Equation. In the equation, C is the cutting speed for a one-minute tool life and n is the slope of the curve. This slope is dependent on the tool material-work material pair, but mainly on the tool material. When no experimentally obtained values available, the average values shown in the table, at the top of page 82 can be used for machining steel.

Example 1—Milling: Only simple algebra is required to apply the equations. A typical problem follows.

A 3 x 3 x 12-inch workpiece of AISI 1040 steel is to be rough face-milled to 2⅞ x 3 x 12 inches. A feed rate of 0.010 ipt is planned, with a 12-tooth, 14-inch cutter. The production information known to apply to this job is:

Loading, unloading and machine handling time (T_l) = 1.6 min
Tool changing time (T_c) = 2.8 min
Labor cost (L_m) = \$2.00/hr = \$0.033/min
Burden (B_m) = \$4.00/hr = \$0.066/min
Setup cost (C_s) = \$0.10/piece
Depreciation of cutter per grind (D_c) = \$0.50
Grinding time (T_g) = 40 min
Grinding labor cost (L_g) = \$2.00 hr = \$0.033/min
Grinding burden (B_g) = \$3.00/hr = \$0.050/min

Using the equations and this information, it is possible to determine optimum tool life and cutting speed, and cost per piece for minimum cost and maximum production.

For minimum cost (assuming that $n = 0.30$):

$$T = (1/n - 1)\frac{T_c\ (L_m + B_m) + T_g\ (L_g + B_g) + D_c}{L_m + B_m}$$

$$= \left(\frac{1}{0.30} - 1\right)\frac{2.8\ (0.033 + 0.066) + 40\ (0.033 + 0.05) + 0.50}{0.033 + 0.066}$$

$$= 92 \text{ min}$$

For maximum production:

$$T = (1/n - 1)\ T_c$$

$$= \left(\frac{1}{0.30} - 1\right)(2.8)$$

$$= 6.4 \text{ min}$$

If experimental cutting speed—tool life data are available, it is only necessary to plot cutting speed against tool life on a log-log graph to determine optimum speed. Assuming these data are not available, it may be possible to obtain a value for V_{60}—the cutting speed for 60 minutes—from a handbook. (See Section 18-32 of the *Tool Engineers Handbook*, second edition.) This value can be corrected to give the required tool life with the following formula:

$$V_T = V_{60}\left(\frac{60}{T}\right)^n \quad \text{.....(11)}$$

For minimum cost (assuming $V_{60} = 550$ fpm):

$$V_T = 550\left(\frac{60}{92}\right)^{0.3} = 480 \text{ fpm}$$

For maximum production:

$$V_T = 550\left(\frac{60}{6.4}\right)^{0.3} = 1078 \text{ fpm}$$

To determine the total cost, the value of T_m calculated from Equation 4 and the number of pieces per grind, N, from Equation 5, are substituted in Equation 2. For minimum cost:

$$T_m = \frac{\pi\ dD}{12\ FVt}$$

$$= \frac{\pi\ 12\ (14)}{12\ (0.010)\ (480)\ (12)} = 0.76 \text{ min}$$

$$N = \frac{T}{T_m} = \frac{92}{0.76} = 121 \text{ pieces}$$

$$C_p = T_m\ (L_m + B_m) + C_s + T_l\ (L_m + B_m) + \frac{T_c\ (L_m + B_m) + T_g\ (L_g + B_g) + D_c}{N}$$

$$= 0.76\ (0.033 + 0.066) + 0.10 + 1.6\ (0.033 + 0.066) + \frac{2.8\ (0.033 + 0.066) + 40\ (0.033 + 0.05) + 0.50}{121}$$

$$= \$0.369 \text{ per piece}$$

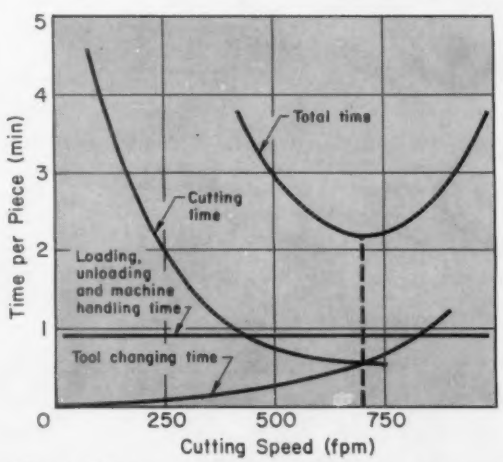


Fig. 2. Effect of cutting speed on time per piece.

For maximum production:

$$T_m = \frac{\pi dD}{12\,FVt}$$

$$= \frac{\pi\ (12)\ (14)}{12\ (0.010)\ (1078)\ (12)}$$

$$= 0.37 \text{ min/piece}$$

$$N = \frac{T}{T_m} = \frac{6.4}{0.37} = 17$$

$$C_p = 0.37\ (0.10) + 0.10 + 1.6\ (0.10) + \frac{0.28\ (0.10) + 40\ (0.083) + 50}{17}$$

$$= \$0.533 \text{ per piece}$$

Example 2—Turning: The optimum tool life for minimum cost and for maximum production for a turning operation is determined in much the same way as for a milling operation. As an example, a four-inch-diameter, 10-inch-long shaft is to be rough turned to 3⅞ inches with throwaway carbide tooling. The following production data are available:

Labor plus burden $(L + B)$ for the shop and the toolroom = \$8.00/hr = \$0.133/min
Cost of one toolholder = \$14.40

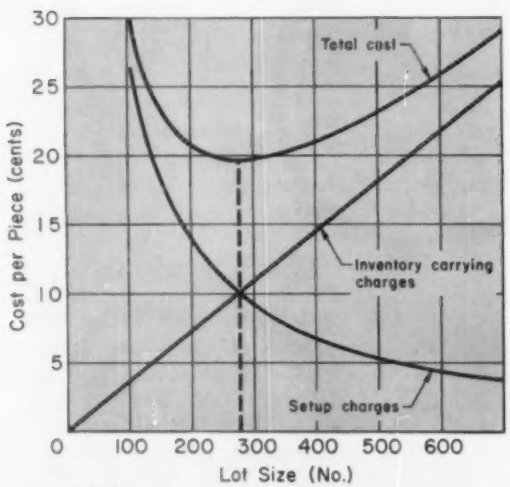


Fig. 3. Effect of lot size on cost per piece.

Cost of toolholder, depreciated in 200 edges = \$0.072/edge
Cost of insert (lot size is 25) = \$0.89
Cost of edge (eight edges) = \$0.111/edge
Depreciation of cutter per edge (D_e) = \$0.183
Tool regrinding time $(T_g) = 0.00$
Tool changing time $(T_c) = 0.25$ min

For minimum cost:

$$T = (1/n - 1)\ \frac{T_c\ (L + B) + T_g\ (L + B) + D_e}{L + B}$$

$$= \left(\frac{1}{0.3} - 1\right)\ \frac{0.25\ (0.133) + 0\ (0.133) + 0.183}{0.133}$$

$$= 3.7 \text{ min}$$

For maximum production:

$$T = (1/n - 1)\ T_c$$

$$= \left(\frac{1}{0.3} - 1\right)\ (0.25)$$

$$= 0.57 \text{ min}$$

Determining Cutting Speed: If several parts are to be run, an accurate method for determining cutting speed is to obtain the cutting speed-tool life curve for this particular operation. One tool should be run at a speed estimated to give the required tool life. The actual tool life is then recorded. Because of human nature, the estimated speed will usually be too slow. Another tool should be run at another cutting speed—preferably too fast—and its life recorded. This data can be plotted on log-log graph paper to determine the actual n value. (Two simultaneous equations can also be used.) If the experimental n differs from the assumed n, the optimum tool lives should be recomputed. Then the proper speed can be determined from the graph.

Other Costs: The time spent in loading the part, rapid feeding of the tool to the start of the cut, returning it after the cut, unloading the piece, changing speeds and feeds, and so on, can amount to 80 percent of the floor-to-floor time. It is essential, therefore, to reduce these costs.

Doubling the lot size will cut the setup cost per piece in half. This may be offset, however, by the cost of storage and the interest charge on the inventory.

Fig. 3 shows that an increase in lot size decreases the setup cost per piece and increases the inventory carrying charge. Then the sum is minimum at the optimum lot size, which is given by the formula:

$$L_s = \frac{24\ ms}{KV_p\ (1 + mv)}$$

where V_p is the value of each piece, dollars; K is the annual carrying charge per dollar of inventory, dollars; L_s is the optimum lot size, pieces, m is monthly consumption, pieces; s is setup cost per lot, dollars; and v is the ratio of machining time to lot size, months per piece. A nomogram in the *Tool Engineers Handbook* (Section 2-11) can be used for this calculation.

Although the steps covered in this article—determining optimum tool lives and cutting speeds, and optimizing other costs as well—are simple, production experience has shown that they are a sure way to "get the most out of machining" and, ultimately, to reduce America's metalcutting bill.

Note: This type of analysis was originally developed by W. W. Gilbert. See "Economics of Machining," *Machining Theory and Practice.* (American Society for Metals, 1950).

putting PLASMA JETS to work

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Plasma-arc torches are used for metal-cutting, plating and welding operations. The stability, ease of control and freedom from combustion products of the plasma flame, and its ability to achieve high temperatures, has made it an important tool in Space-Age manufacturing. The author covers applications.

Fig. 1. Plasma-arc torch being used to deposit a metal coating on a production part.

WITH THE ADVENT of the Space Age, many new production tools have come into common use. One of the more interesting and useful of these is the plasma-arc jet, which was introduced into metal-working plants only five years ago. The extremely high temperatures possible with plasma-arc jets have made them essential for working carbides, oxides and refractory materials. Unlike chemical flames, they can be used on highly reactive materials. Added to these desirable characteristics are the inherent simplicity of plasma-arc jet equipment, *Fig.* 1, and the ease with which heating can be controlled.

A plasma is simply an ionized conducting gas—the luminous gas seen in electric-arc welding, carbon-arc lighting and in the electric furnaces used to melt steel and ferroalloys. When forced through a nozzle, this gas becomes a plasma jet. The high concentration of energy that results from squeezing an arc through a nozzle produces extremely high temperatures and voltages.

The constricted arc has several advantages over the conventional gas-shielded arc, notably arc flame stability and concentration of power. These advantages are best realized when the nozzle is made as small as possible for a given use. For example, in plasma-arc cutting, the power may be 500 amp at 100 v, with 100 cfh of gas flow. At an average gas temperature of 10,000 to 15,000 k, 50 kw are delivered through the nozzle. The power concentration is 3 megawatts per square inch for a nozzle ⅛ inch in diameter. The velocity of the gas approaches sonic speeds at these temperatures.

Torch Design: In a plasma jet torch, *Fig.* 2, gas under pressure flows through or past an electric arc. This gas is heated to at least a partly ionized

From a paper presented at the ASTME Seminar "Machining and Forming of Space-Age Materials." Single copies of the complete paper are available without charge from Society Headquarters.

state and thus becomes conductive to electricity. Some gases, particularly metal vapors, ionize at a few thousand degrees Fahrenheit. Others, such as helium, require temperatures of 20,000 to 30,000 F for ionization. The arc gas or plasma acts as the element of a resistance heater. It is kept at these high temperatures by the electric current.

Nitrogen, argon and hydrogen gases are commonly used in plasma jet torches. While the temperatures in the hydrogen and argon arcs are both within the 35,000 to 50,000 F range, hydrogen has a much higher thermal conductivity and consequently much more heat can be transferred through a hydrogen arc.

There are several reasons for the superior heat-transfer characteristics of hydrogen. As the hydrogen content is increased (at a given current) the voltage drop across the plasma increases, and more heat is put into the plasma. Due to the low molecular weight of hydrogen, much higher velocities are obtained than is possible with other common gases. Also, at arc temperatures the diatomic hydrogen molecule disassociates, forming atomic hydrogen which, on recombination, gives up large quantities of heat. As can be seen from TABLE 1, the flame intensity of a torch using hydrogen gas can theoretically be about 50 times that of a torch using argon gas and over 100 times greater than that of an oxyacetylene flame.

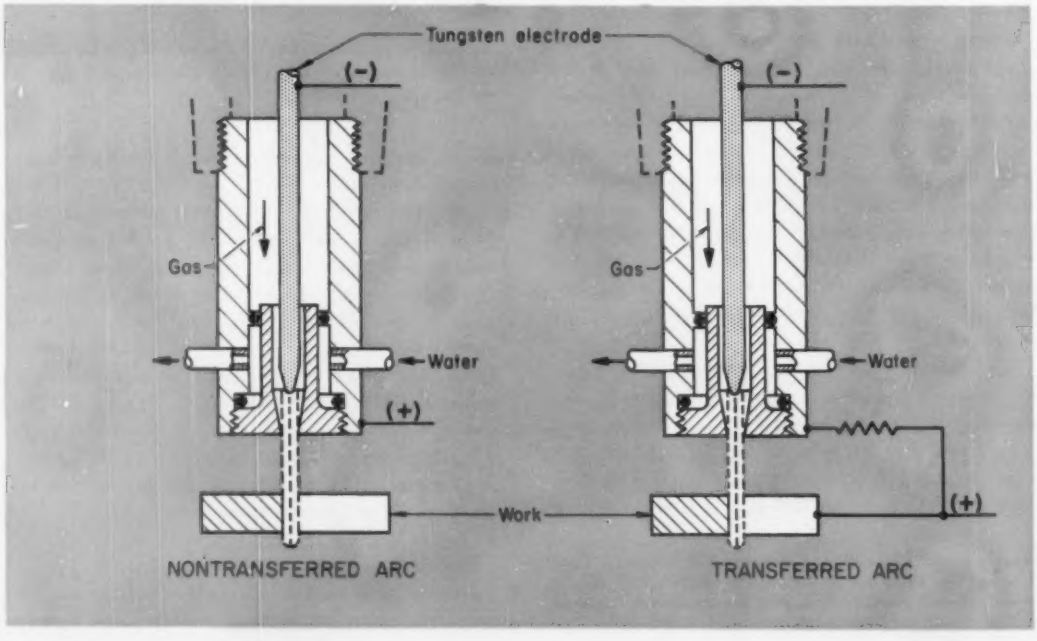
The nozzle in a properly designed torch can withstand arc temperatures because an annular layer of cool gas having a steep radial temperature gradient surrounds the arc column proper and is adjacent to the nozzle wall. The relatively cool nonconductive gas at the wall forms a tube of electrical and thermal insulation to stabilize the arc column centrally in the nozzle and thus to protect the nozzle. This insulation is effective to the extent that, in metalcutting, less than 10 percent of the total heat goes to the nozzle, mostly as radiant heat from the arc.

Table 1—Flame Intensity of Heating Devices

Type of Device	Temp (deg K)	Intensity (kcal/cm²/sec)	Typical Use
Bunsen burner	1400	0.1	soft soldering
Blow torch	1900	0.5	silver soldering
Oxy flame	3000	1	welding
Jet burner	3000	8	rock spalling
Nontransferred arc torch (argon gas)	8000	4	heating
Nontransferred arc torch (hydrogen gas)	8000	114	metalcutting

In the "transferred" arc torch, shown on the right in *Fig.* 2, both the arc and the gas stream continue to the work after leaving the nozzle. The work is the anode in the circuit. The efficiency and intensity of heat transfer are the highest with this type of torch, which is used for metalcutting. In the "nontransferred" arc torch, shown at the left in *Fig.* 2, the arc is forced into and perhaps through the nozzle by the flow of gas. The arc ends on the nozzle and the hot gas passes through. Since the two arc electrodes are inside the torch, only the

Fig. 2. Schematic cross sections of nontransferred and transferred arc torches.



hot plasma flame emerges. This type of torch is used for plating.

Cutting: When cutting using the transferred arc was first developed, it was capable of cutting aluminum plate up to 1½ inches thick. The process has since been improved so that now it can be used to cut up to 5-inch-thick aluminum plate, as well as 4-inch-thick stainless steel, copper, magnesium and many other metals. The advances have come about mainly through the development of torches with higher power capacity. Typical cutting conditions for a variety of metals and thicknesses are shown in TABLE 2, which covers mechanized plasma-arc cutting operations. Both argon-hydrogen (A-H_2) and nitrogen (N_2) gases are used. Nitrogen is not recommended for manual torch operations, incidentally, because of the health hazard presented by the formation of nitrogen oxides.

The experience of several tank fabricators when cutting ⅝-inch-thick aluminum shows that plasma-arc cutting is at least ten times faster than mechanical cutting. The quality of cut surfaces produced by the plasma-arc is high and equals that produced in the oxygen cutting of mild steel. It should be pointed out that plasma-arc cutting, unlike oxygen cutting, can be used to cut metals like aluminum, which form refractory oxides.

Plating: The plasma-arc plating process permits the exact and rapid mass production of parts from ultrahigh melting point materials. Solid material is introduced into the hot gas stream in either powder or wire form. When fine powder is used, the individual particles are melted and accelerated to velocities near the gas-stream velocity. When a wire is used, it is melted and droplets are then sheared from the molten zone by the high-velocity gas to form a fine spray. In either case, the molten particles are propelled against a workpiece where they flatten out and solidify to form a coating.

The principal advantage of the plasma-arc process in coating work lies in the ease with which temperature and atmosphere can be controlled. This

Table 2—Mechanized Plasma-Arc Cutting

Material Cut	Thickness (in.)	Type of Gas	Flow (cfh)	Current (amp)	Voltage Setting	Speed (ipm)
Aluminum	¼	A-H_2	60	400	70	300
	1	A-H_2	70	400	72	50
	2	A-H_2	100	700	87	35
	4	A-H_2	300	700	155	13
	5	A-H_2	300	700	170	8
Copper	¼	A-H_2	60	400	70	75
Magnesium	1	A-H_2	70	400	70	100
Stainless steel	¼	N_2	70	400	60	110
	1	A-H_2	100	500	80	25
	2	A-H_2	100	700	85	15
	4	A-H_2	300	700	160	5

Note: When A-H_2 is used, it consists of 65 percent argon, 35 percent hydrogen

Fig. 3. Tungsten-coated graphite rocket nozzle.

feature is most important where the coating material is sensitive to oxidation or other chemical changes such as those which can occur in a chemical flame or in air. The ability to reach higher temperatures than those obtainable with normal chemical flames is significant for many of the refractory metals and compounds. These two characteristics of the plasma-arc are illustrated by the plating of tungsten. The high (6160 F) melting point of this material and the ease with which it is oxidized or contaminated

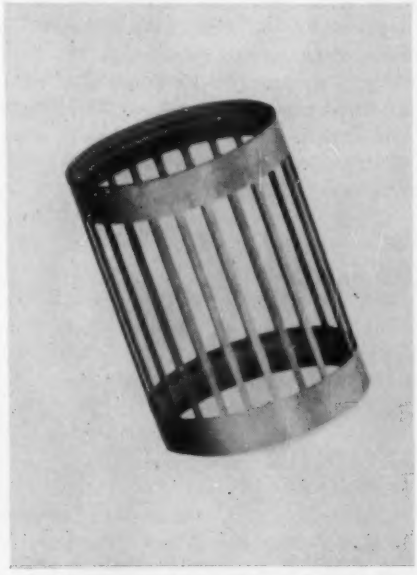


Fig. 4. Electronic grid cage produced from tungsten by plasma-arc techniques.

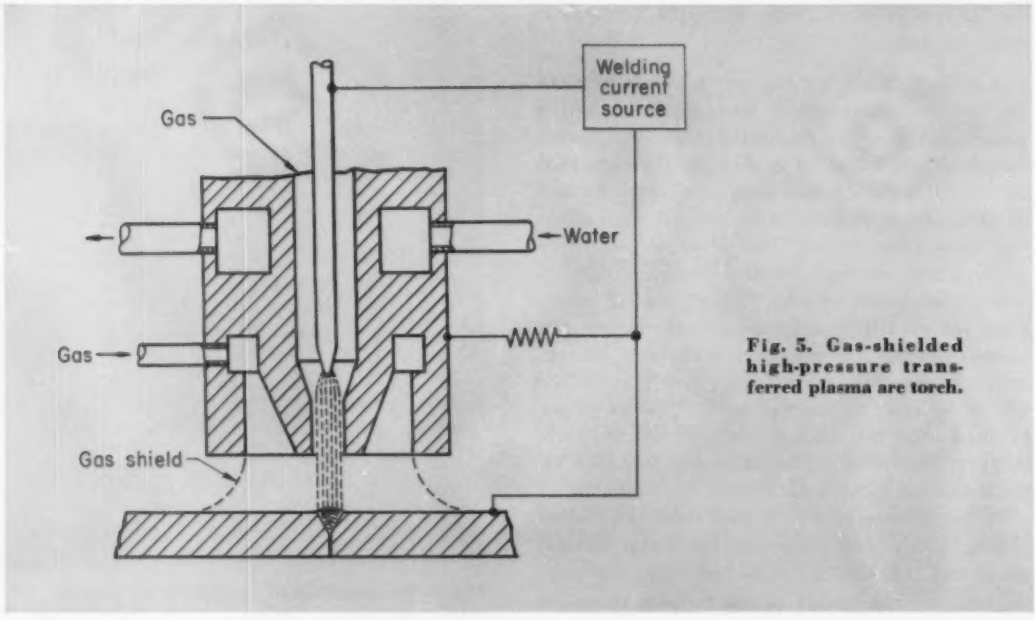


Fig. 5. Gas-shielded high-pressure transferred plasma arc torch.

by other elements present no problems for a plasma-arc operating on pure argon.

Theoretically, it is possible to make a coating of any material that melts without excessive vaporization or decomposition. In practice, thermal conductivity, heat capacity and emissivity affect the ease with which particles can be uniformly melted. Operating parameters such as gas flow, arc current, coating material feed rate, and equipment design, must be studied carefully in relation to the materials being coated and the nature of the coating desired. In general, good coatings can be made with most metals and alloys, most of the refractory oxides and many of the refractory carbides.

Tungsten provides an example of what can be done with plasma-arc coatings. This metal has been applied as a coating in thicknesses of a few mils to ½ inch on metals, graphite and some special grades of heat-resistant plastic.

An important application for these coatings is the use of tungsten to protect graphite rocket nozzles, *Fig.* 3. Tests by several major rocket motor producers have shown that tungsten coatings provide good protection from high temperatures and pressures. Intricate shapes, some of which cannot be made by conventional fabricating methods, can be produced by coating a metal mandrel and then removing the mandrel by acid leaching or other means. The coating has a modulus of rupture of at least 50,000 psi and a density of 89 percent of theoretical as desposited. These values can be increased by heat-treating the shapes. The electronic grid cage shown in *Fig.* 4 was produced from tungsten by plasma-arc techniques.

Welding: Plasma-arc torches are also used for welding, *Fig.* 5. The higher voltage and power and the higher attainable concentration of energy flow provided by the transferred arc are demonstrated in TABLE 3, in which bead welds made with an unconstricted arc are compared with those made with an arc constricted by a $\frac{5}{32}$-inch inside diameter nozzle. The material is AISI Type 304 stainless steel. Current is 175 amp. Welding speed is 10 ipm and the shielding gas is pure argon.

During welding, the transferred arc moves along the joint and the plasma, shielded from the air by the outer annular shielding gas stream, melts a seam which, as the torch moves away, cools and solidifies. The plasma produces a remarkably small variance in weld bead dimensions over a wide range

Table 3—Unconstricted versus Constricted Arc

Type of Arc	Arc Length (in.)	Arc Voltage	Bead Width (in.)	Penetration (in.)
Unconstricted	¼	16	0.305	0.075
	⅜	18	0.240	0.045
Constricted	⅜	26	0.255	0.090
	⅝	29	0.260	0.080

of torch-to-work distances, as seen in the table. The plasma torch is also well suited for flange-welding sheet metal parts at high speed.

A small arc torch has been used to weld 0.007-inch-thick stainless sheet at 25 ipm, using 15-amp current. Argon is passed through a $\frac{1}{16}$-inch-diam-

eter center orifice at a rate of ¾ cfh and is used at the rate of 25 cfh of argon in the surrounding envelope. The effluent (stream of ionized gas) is stable and has no tendency to wander.

Other Uses: Metalcutting, coating and welding do not exhaust the potential of the plasma-arc. The torch shown in *Fig.* 6, for example, produces a flame that is from three to six times hotter than that of the oxyacetylene flame and it is easily controllable up to 10 inches or more in length. The plasma produced by this torch melts sapphire and zirconia and can be used for heating, brazing, soldering or as a source of high-intensity light. The torch can also be used for producing chemical reactions by introducing a second gas into the chamber. The arc can be adjusted by varying current, gas composition, gas flow and orifices to give an effluent hot enough to melt tungsten or cool enough to barely char wood. This versatility should lead to a wide range of applications where the economy and stability of the plasma-arc is needed in production.

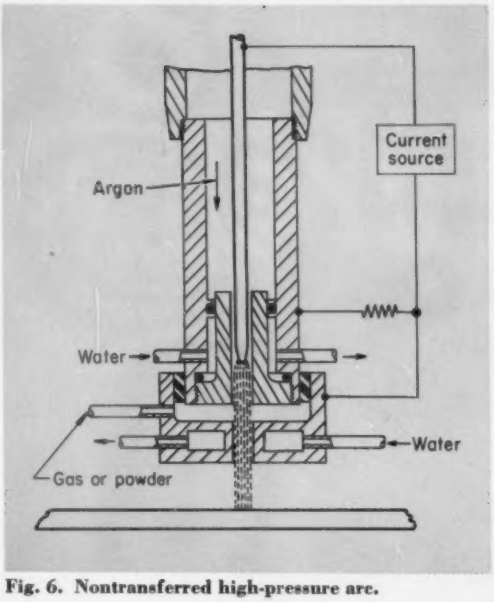


Fig. 6. Nontransferred high-pressure arc.

Plastic Dish Protects Missile Engine

DUMONT MANUFACTURING CORP., San Rafael, Calif., is producing for the first-stage Air Force Minuteman ICBM a 400-lb, 60-inch-diam reinforced plastic dish. Compression molded to close tolerances in one piece and in a single press shot, the 14-inch-deep dish is the aft closure insulation for the Minuteman engine. Its purpose is to protect the steel structural casing from damage by burning propellant.

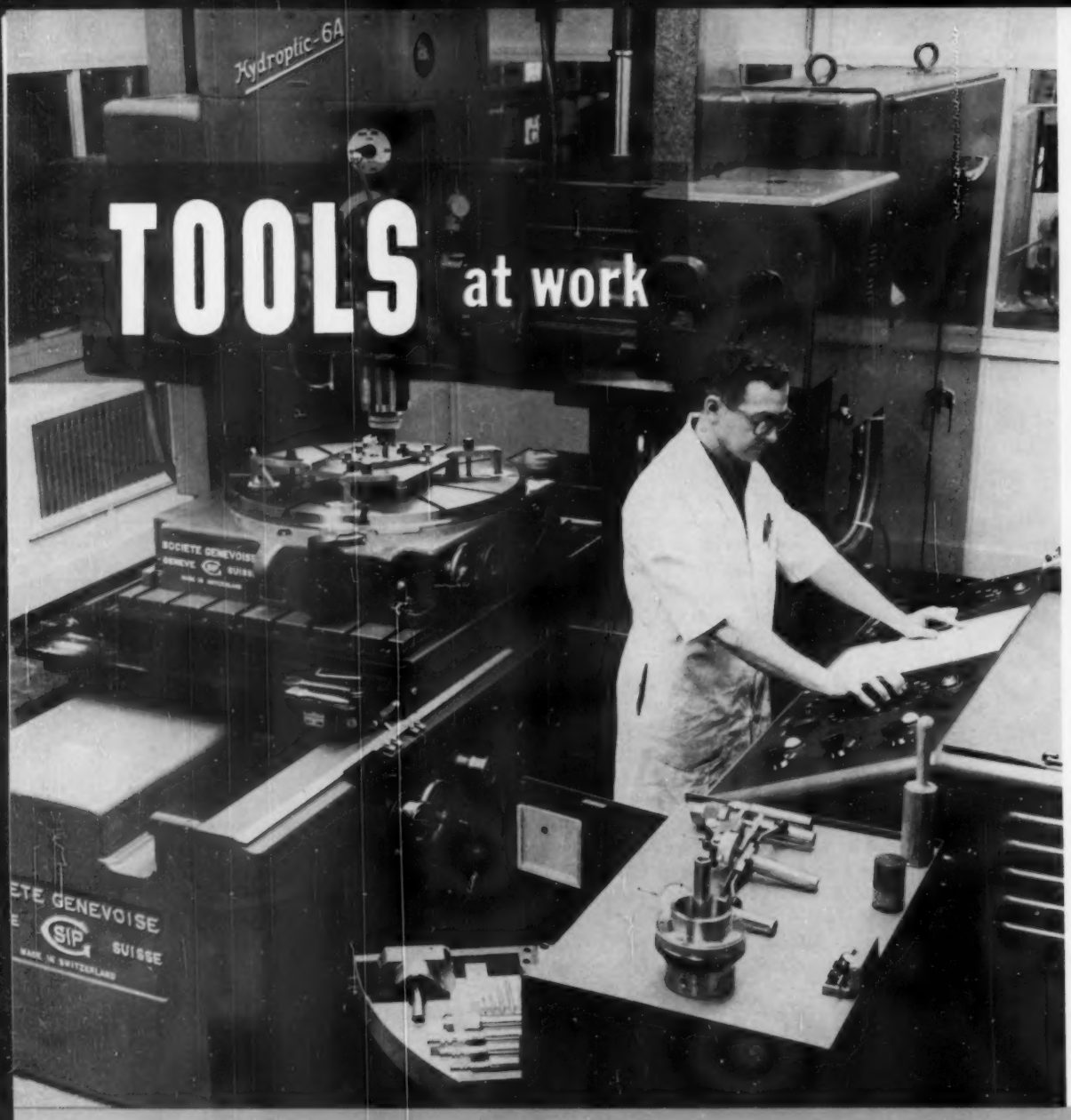
Success or failure of missile launchings depends to a large extent on the performance of insulative components as a whole, of which the dish is a vital member. An ablative insulation is mandatory above the nozzles. While the steel casing could withstand the erosive influences created by the propellant, it cannot take the heat. The molded plastic dish—subjected to temperatures in excess of 5000 F at high pressures—will continue to insulate the steel casing for the life of motor firing. In service, the dish will slowly burn and char on the nozzle side, but will hold the temperature on the casing itself to a maximum 200 F.

Different types of molded dishes consisting of high-temperature resistant phenolic resins reinforced with silica, asbestos and graphite fibers, singly or in combination, will be fabricated by Dumont for the Minuteman. They will be molded in one piece rather than in smaller sectioned moldings to be bonded together for several reasons.

First, a single molding is considered to be more reliable than bonded sectioned moldings. Second, manufacturing processes stripped to one-tool molding are more economical and faster. Third, Dumont has at its disposal a 2000-ton press which makes one piece moldings such as the dish a practical reality. This steam-heated press was designed specifically for producing large, reinforced plastics moldings but can be used also for smaller plastics moldings which require extremely high pressures of 10,000 or more psi. It has an 8-ft. stroke which permits rapid die changes without incurring the usual extra labor for handling spacers.

Aft closure insulation for the Air Force Minuteman ICBM engine is pulled from die after being compression molded in one piece and in a single press shot. The reinforced plastic dish weighs 400 lb.

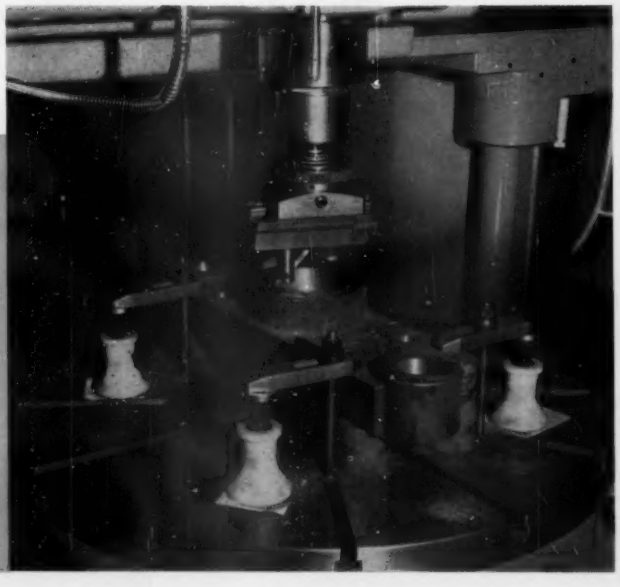
TOOLS at work



OPERATING in a temperature controlled room at the Columbus plant of The Timken Roller Bearing Co., this jigbore positions from a magnetic memory of previously accomplished operations. In use, the operator centers each hole using a locating microscope to optically locate for the first operation (right). The magnetic memory simultaneously records the location. Once the motion is recorded, it can be used as many times as desired, eliminating the need for repeating the slow optical measurements. For subsequent operations at the same location, such as boring and facing (lower right), pushing a button causes the machine to operate from its memory. Up to 40 such positions can be stored and automatically repeated to an accuracy within 0.00002 inch.

Savings in over-all production time using the DIR device (memory drums and controls) varies between 8 and 20 percent, depending on the type and number of pieces machined. Greater savings are realized when repetitive jobs are recorded on a drum and filed. The job can then be rerun easily whenever required. The machine, a SIP Hydroptic, is also used for machining tool slides to close tolerances, eliminating much scraping time.

OPERATOR centers each hole optically for initial boring operations.



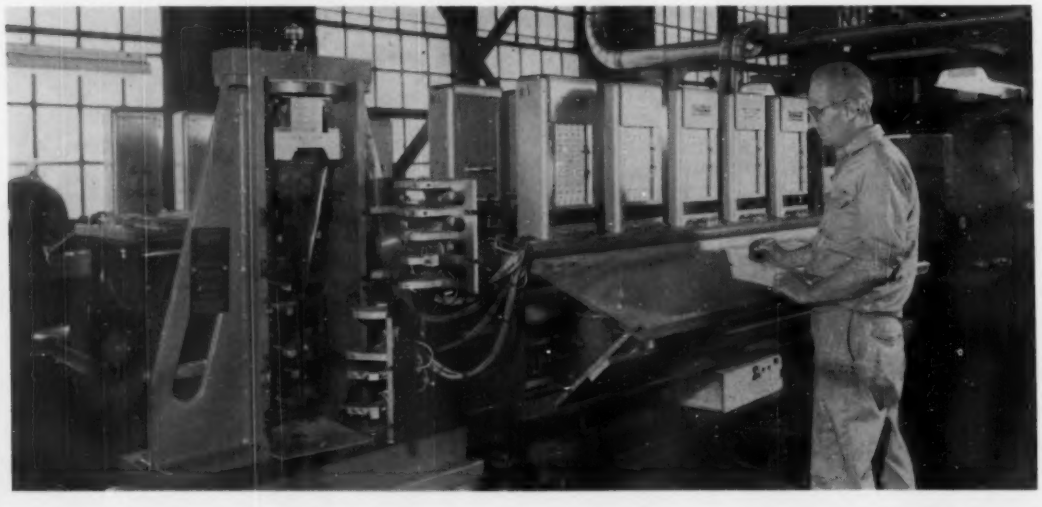
HOLE LOCATIONS are recorded by a memory unit once they are established optically. Thus jobs like that on the right are quickly re-run.

ULTRASONIC TESTING is used to check the metallurgical properties of this large 5000-pound gas turbine forging. The workpiece began as 11,000 pounds of molten metal for casting an ingot of Discaloy, an iron base, austenitic, high-temperature alloy, precipitation hardened with titanium. A special ingot mold was designed to obtain proper solidification and minimum segregation during cooling of the ingot. The ingot was press-forged in a series of heats into a 23-inch round billet, upset-forged, made into a disc forging and rough machined. In the form shown for inspection, the piece has a 44-inch diameter and is 10 inches through the thickest part.

After all metallurgical tests are completed, the disc will be transferred from the Westinghouse metals plant to the industrial turbine department for final machining and assembly. When completed, one row of 43 turbine blades will be mounted radially around the disc circumference. For use in a gas turbine, the workpiece will operate at temperatures between 1100 and 1250 F.

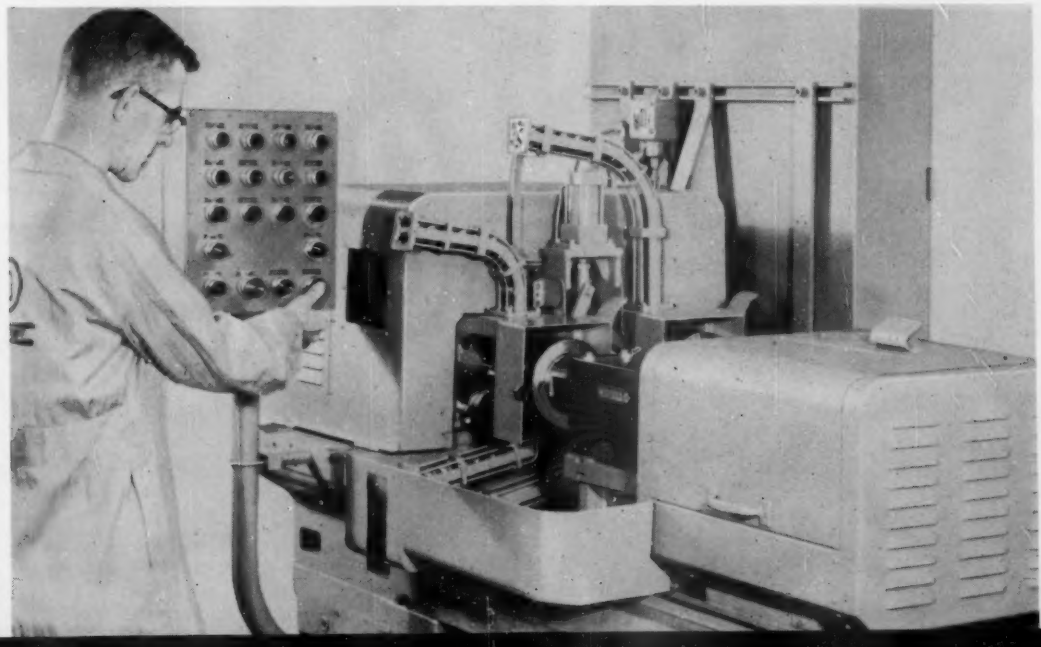
TOOLS at work

COMPLEX, multistation inspection and measurement of compound-curve workpieces is accomplished with efficiency and accuracy at the West Allis works of Allis-Chalmers Manufacturing Co. The workpiece, a turbine blade, is mounted in the holding fixture at the left. Air gage heads are mounted in gates hinged to opposite sides of the fixture. When both the fore and aft gates are closed, 25 gage heads are positioned along the blade surface, and 25 readings are obtained simultaneously. The positions of the air-floats in the adjacent flow gages (mounted on bench, at right in photo) give the center of gravity location to an accuracy of 0.002 inch at nine sections in the blade. The air gage device is used to inspect both production line output of steam turbine blades and special developmental blades.



BOTH THE MACHINE and the tooling are operated near the uppermost limit of their capabilities in the machining of tough forged gears at the United Engineering & Foundry Co. These and similar workpieces are used in large steel mill production equipment and are machined automatically in the Warner & Swasey single spindle chucker. Workpieces are frequently so large that they require the full swing capacity of the machine. Heavy cuts, up to one inch depth demand the drive motor's full 40 horsepower and sometimes involve temporary overloads. Despite heavy cuts, accuracy is held within 0.001 inch. Small lot production (lot sizes average from 20 to 100 pieces) has been improved by about 400 percent over the methods previously used.

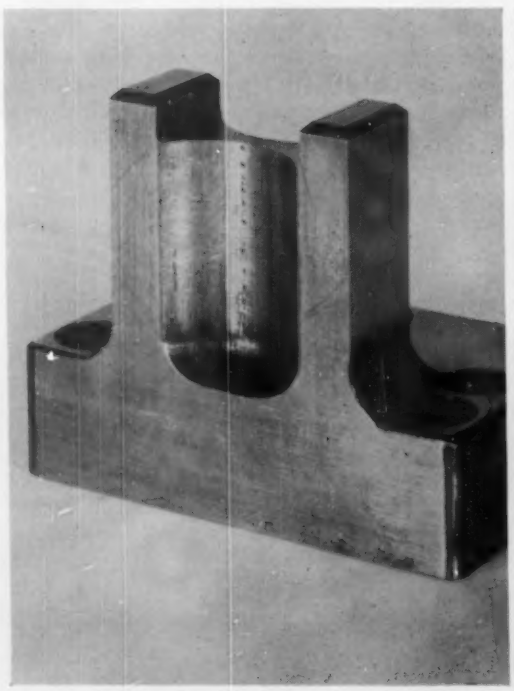
CONTINUOUS and automatic production of automotive transmission planet carrier pinion blanks is run at a rate of nearly 400 parts per hour on this boring machine. Fast-acting air cylinders operate the work handling mechanism. Gravity-fed parts move through the chutes and are precisely located and clamped. Boring is completed in 9 seconds. An automatic quill movement permits the tool to clear the workpiece without leaving drawback lines. The finished parts are then released and dropped into a discharge chute as the next cycle begins. The Ex-Cell-O boring machine has a micrometer adjustment on the quill for rapid and accurate tool setting. Accuracy of bore size is held to within 0.0006 inch and the bore is held square to the faces of the part within 0.0003 inch.

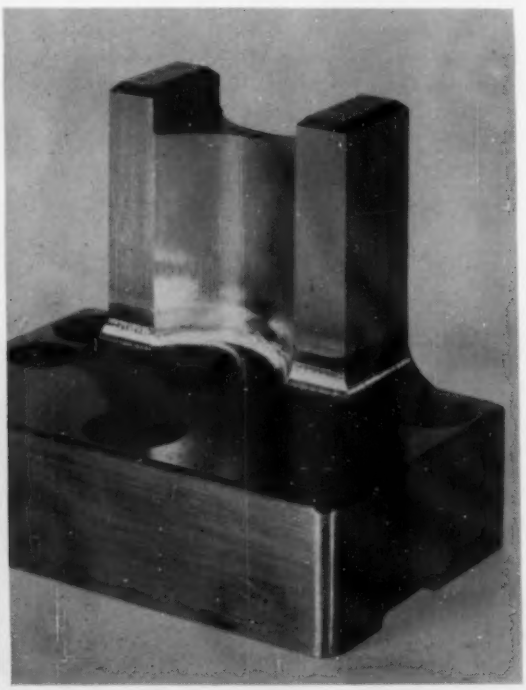


GRINDING the sides of a punch in the longitudinal direction reduces the tendency toward galling and increases punch life. The Kar-Ry belt grinder shown improves direction of finish and also enables a 50 percent or better time savings over bench work methods such as hand filing and stoning. The belt-carrying platens are small, which enables the abrasive belt to grind intricate shapes and to reach into narrow and tight openings that were previously accessible only to hand methods. The platen can be lowered into die openings and accurately set to relief angles of 0.25 deg, 0.5 deg or 0.75 deg, using the indicator. Accuracy obtainable on offhand work is influenced by operator skill. Accuracies within 0.0005 inch are obtainable by this method. Radius work is done using standard toolroom fixtures.

The quality and direction of finish produced by belt grinding is shown in the closeup photo of another typical workpiece. Finish depends on the size of the abrasive grit—with a 100 grit belt, a 12 to 15 microinch finish is obtained.

TOOLS at work





how to cut
TOOL AND DIE COSTS
Part 4—Steel Selection

By J. S. Pendleton, Jr.
Metallurgist
The Carpenter Steel Co.
Reading, Pa.

Steel selection — one of the most important factors in tool and die costs — can be simplified by using matched steel sets. In this article the author explains how the best steel can be selected and used to maximum advantage.

THREE PREVIOUS ARTICLES in this series have shown how tool and die costs can be reduced by economizing in time, increasing service life and reducing heat-treating failures. However, much of this is meaningless unless the proper steel is selected for the job on hand. Obviously, it does little good to design a tool to pass through heat treating only to have it fail in service. Many such failures can be eliminated if the material used is selected for the job according to conditions of tool operation, production requirements and material stamped.

Job Analysis: Analysis of the job to be done is an important prerequisite when steel is selected. After the analysis has been made, it will be found that certain compromises are necessary since all the desired properties cannot possibly be found in one steel. Therefore, it is necessary to select steel on the basis of the one or two of the most critical properties required. These properties—toughness, hardness, wear and shock resistance—are influenced by tool design, tool function, press equipment and the materal to be worked.

DESIGN OF THE TOOL: The most important consideration related to tool design is the safety factor required in heat treating. This factor is contingent upon the balance of the tool and whether it has notches or relatively thin sections. Although the steel selected may be suitable in all other respects, if it cannot survive heat-treating without fracture or distortion, it is obviously a poor choice.

THE JOB TO BE DONE: Because press tools perform a wide variety of operations such as coining, blanking, extruding, hobbing, drawing, bending, a wide range of steels is required. For example, cold blanking dies for shaving and blanking must hold size to close tolerances. In other dies, maintenance of size is relatively unimportant. In coining dies, galling, spalling, crumbling and chipping on sharp edges are basic considerations. Cold extrusion dies must have hard wear-resistant surfaces to avoid galling and abrasion. Hobbing dies require keen, wear-resistant cutting edges which have the ability to hold an accurate form.

EQUIPMENT TO BE USED: The equipment indicates the amount of shock to which the tool is subjected and the speed with which it will operate. A hammer will subject a tool to a much greater shock load than a press, and a high-speed hammer will produce more shock load than a low-speed hammer. Speed and shock are important considerations when tool life is evaluated and attempts are made to prolong its life.

MATERIAL TO BE WORKED: Gage, abrasive qualities, type of operation, heavy or light gage, whether it is hot or cold worked, and length of production

Fig. 1. Blank and pierce die for producing automotive grills. To preserve accuracy, all cutting edges are made of HCHC steel.

runs are factors which determine how wear-resistant, abrasion-resistant or heat-resistant the tool steel must be.

Other considerations, secondary in nature but of major importance, include the heat-treat facility, the setup man's ability and the quality of die maintenance. As each of these factors is checked off, a pattern emerges which indicates the best steel for any given job.

Tool Steel Properties: Certain properties in tool steels are obtained by varying the alloying elements—carbon, manganese, chromium, nickel, tungsten, vanadium, molybdenum, cobalt, and columbium, to name a few. Unfortunately, some of these properties are incompatible in that one must be sacrificed to obtain another. For example, toughness or resistance to brittle failure cannot be obtained in combination with extremely high strength. Paradoxically, strength and wear resistance are distinctly related. Red hardness, however, is not related to any of the others except that the amounts of alloy required to produce it may reduce toughness.

The most important alloying element in tool steel is carbon. Its function is to make the steel harder and increase its properties of wear resistance. Hardness increases in a direct relationship to the carbon content up to approximately 0.80 percent carbon. Above this percentage, the steel does not become any harder, although it becomes more wear resistant. Approximately one percent carbon is generally associated with the majority of alloy tool steels.

Although varying amounts of carbon have a distinct effect on the hardness of the tool steel, carbon has very little effect on hardening depth. Plain carbon tool steels will harden only to a depth of 3/32 or 1/8 inch no matter how much carbon they contain. Depth hardening can be obtained, however, by additions of manganese, molybdenum or chromium. Manganese has two additional effects not shared by molybdenum or chromium in that it minimizes size change during hardening, while lowering the hardening temperature.

Chromium contributes wear resistance and toughness to a greater degree than manganese but its effect on these properties is largely dependent upon the carbon content of the steel. Chromium works in the opposite direction of manganese by raising temperature necessary for hardening. Nickel, when used in conjunction with a hardening element, increases toughness and wear resistance without greatly affecting hardenability.

Molybdenum and tungsten are major alloying elements in the red-hard or high-speed tool steels. Tungsten is also added in amounts up to 4 percent in high-carbon tool steel to increase its properties of wear resistance. Molybdenum contributes in many cases to the air-hardening properties of certain tool steels such as A6 and A2.

Tool Steel Classification: From the foregoing it would appear logical if tool steels were classified according to their alloying elements. In this way a manganese, molybdenum or chromium-bearing alloy steel would be adequate when deep-hardening properties were required. If additional toughness and wear resistance were desired, a nickel-based alloy would be selected. Unfortunately, however, classification of steel in this manner is ineffective

when steel is selected for tools and dies.

The AISI method of identification and classification is one attempt to set up workable selection systems. AISI classifies tool steels according to their hardening mediums and functions. In this way *W* signifies water-hardening; *S*, shock-resisting; *O*, oil-hardening; *A*, air-hardening; and *H*, hot-work steel. AISI also identifies tool steel by its major alloying elements. *T* stands for 12 to 18 percent tungsten and *M* stands for 4.5 to 8 percent molybdenum. This system is workable but there are many hot-work steels with 9 to 18 percent tungsten and 5 to 8 percent molybdenum which are excluded from classification by this method.

In practice, the selection process can be simplified by limiting the number of tool steels used. Obviously, no concern requires 50, 60 or 100 different tool steels for the tooling it fabricates. Also, selection should be based on the ultimate use of the steel—not on its chemical composition.

For example, whether a steel contains manganese, molybdenum or chromium is relatively unimportant if increased hardening accuracy or safety is required. Regardless of its chemical composition, greater safety and hardening accuracy are associated with the critical cooling rate, (method of quenching) more than any other factor.

Therefore, it is necessary to have at least one tool steel in each of the hardening classifications—water, oil and air—to meet the requirements of heat-treat safety. These requirements vary significantly. A highly complex die worth thousands of dollars, *Fig.* 1, must be prevented from fracturing in heat-treat. This, of course, requires the use of air-hardening steel. However, the use of expensive air-hardening steel to make a simple punch for perforating paper is an unnecessary expense.

In like manner, it is uneconomical to use tool steel that will wear for 50,000 stampings between grindings if production requirements are only 700 parts. Quite simply, this means that the steel should be matched to the job. Because it is impossible to achieve maximum wear, toughness and hardness in one steel, two or three steels should be selected in each hardening category to meet the varying demands of wear, toughness and hardness. It is also necessary to have two or three special steels for tooling which is operated at elevated temperatures. Because these tools must retain their hardness in operation, they must have the special requirement of red hardness. Alloys such as tungsten, molybdenum, chromium and vanadium have the ability to impart red hardness by either oil or air-quenching. Some red-hard steels are tough but low in wear resistance, while others have high wear resistance, but are relatively brittle.

Selection: After several steels have been selected for each quenching classification, it is necessary to determine how selections within that classification can be made.

Generally, selection of one steel in preference to another is based on the record of previous tool failures. Before the change is made, however, the job history should be examined to make certain that the failure was not caused by some other variable. Improper heat treating, accidents in operation and faulty design may have caused the trouble. Frequently, when a tool is remade with a different steel it is discovered that steel selection had nothing to do with the original failure.

When all possible reasons for tool failure—except the steel—have been eliminated, it is necessary to examine the tool to isolate the exact cause of failure. In this examination variables such as brittleness, abrasion, depth of hardening, weakness and

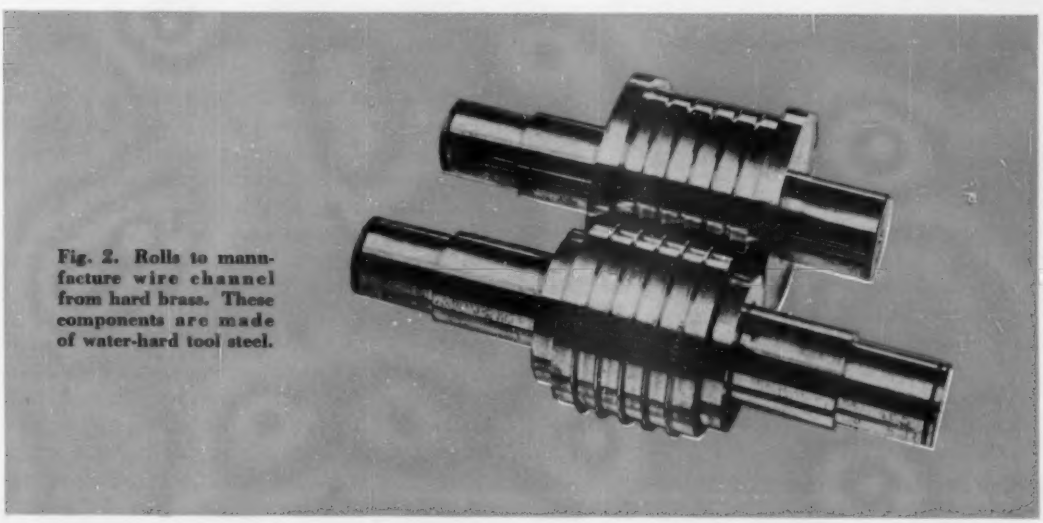


Fig. 2. Rolls to manufacture wire channel from hard brass. These components are made of water-hard tool steel.

upsetting must be considered. When one of these has been identified as the cause of failure, it does not necessarily mean that steel selection is faulty. The solution may not be to change steel, but to change the properties of the original steel. Possibly this can be accomplished by a slight modification of the heat treating procedures. Tempering offers the best prospect for effecting minor changes in the properties of the steel. A little more tempering at slightly higher temperature will reduce hardness and wear resistance but may increase toughness. A decrease in tempering temperature will increase both hardness and wear resistance at the sacrifice of some toughness.

Proof of the value of this system can be shown by analyzing a basic tooling job. Forming or bending die designs should be examined in the light of size and shape, and the job to be done. Must the dies hold size accurately in hardening? Are there nonuniform sections that are apt to crack in hardening? If either answer is yes, oil or air-hardening rather than a less expensive water-hardening tool steel should be selected. The final decision as to whether air or oil-hardening steel is used depends on the degree of safety or accuracy required. The next consideration—the job to be done—requires careful analysis since each type of operation performed has a different effect on the steel.

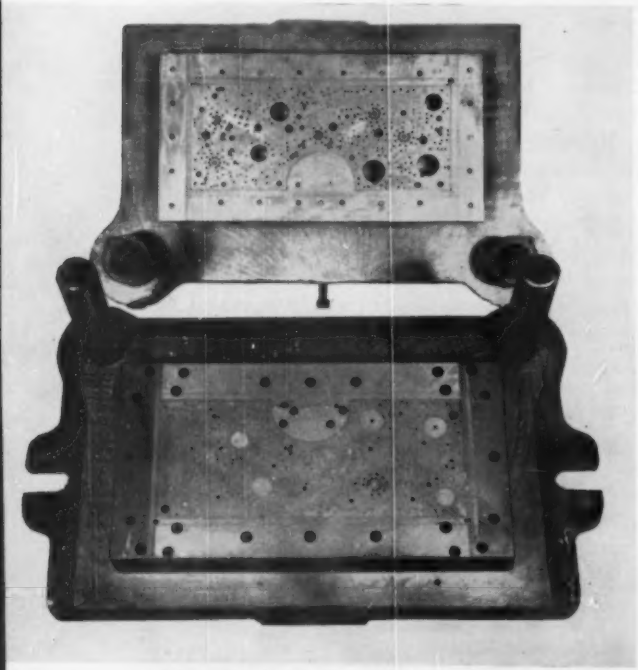


Fig. 3. Complex pierce die for printed circuit boards. Made of air-hardening steel, this die produces 30,000 parts before resharpening is necessary.

Forming or bending is not a particularly critical operation that should influence a decision toward or away from any particular type steel. The equipment normally associated with bending and forming operations would not influence the decision too greatly. The material worked, however, is critical. Light gage steel, nonferrous sheet and wire forming, *Fig.* 2, does not require particular strength or toughness. Therefore, a tool steel providing maximum wear should be used. This could be an AISI D2 or D3 type.

Tougher steels with greater strength are required as the amount of work done by the die increases, *Fig.* 3. This increase can take the form of a heavy "ironing" operation or merely a larger die size. Appropriate steels here would be AISI O2 or A2. Heavy gage material or extra large size dies would require a tool steel of maximum toughness with a fair degree of wear resistance. AISI L6 or A6 are good examples.

Many benefits can be achieved by selecting tool and die steels on the basis of job analysis if a systematic procedure is adopted. This involves selecting a good steel within each category and using it as a "home base." Each new job should then be analyzed for reasons why this particular steel should not be used. Perhaps more wear resistance, toughness, hardening accuracy or safety are required than this steel can provide. If so, the additional costs should be paid—but only when it has been determined that the "home-base" steel is inadequate.

This procedure is relatively simple since all tool steels on the market are hardened in one of three ways: by water, oil or air quenching. The fundamental differences between these groups are hardening accuracy and safety, not toughness or wear resistance. To obtain increased toughness or greater wear resistance, a steel within each of these hardening methods must be selected.

Since it is impossible to obtain both maximum toughness and maximum wear resistance in the same steel, it is necessary to have at least two good steels in each hardening classification. For jobs that represent a compromise between toughness and wear, there should be a compromise steel. In addition, a set of three steels for tooling that must retain its hardness at elevated temperatures is required. These tools have a special requirement of red hardness.

By using this method of analysis, it is possible to reduce the maze of hundreds of tool steels down to a workable inventory of twelve. Three in each hardening category for cold working tools plus three hot work steels will enable tool and manufacturing engineers to make good selections for over 90 percent of their jobs.

Turning with Throwaway Inserts —speeds and feeds for carbides

By **H. H. Poett**, Manufacturing Research Engineer
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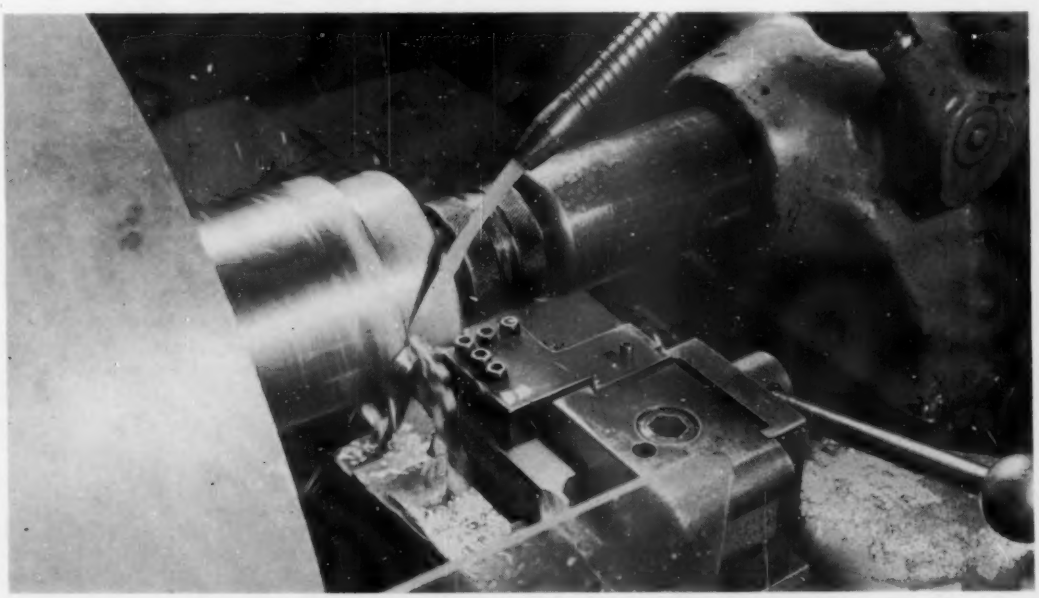
SINCE REPLACEABLE CUTTING EDGES in the form of carbide inserts became available for metal removal, the techniques for obtaining optimum production have changed significantly. Maximum effort at preserving tool life must be abandoned and instead effort should be directed toward operating machines at maximum output. To help direct effort toward achieving increased machining rates, engineers at Lockheed Missiles and Space Div. conducted investigations of lathe work using carbides. The investigations were based on average work, using medium-sized engine lathes. Ceramics were not investigated, as the speed, rigidity and power required were not commonly available on existing machines. Results obtained by this research are compiled in the accompanying table.

The table on the next page has been prepared for use with throwaway carbides only. Considerable increases in production have resulted from use of



Increased lathe output can be achieved by using the accompanying table.

the chart. Another result has been an increasing awareness of the need for effective preventive maintenance. Machines must be in good condition to operate as effectively as the table requires. In using the table, the speeds and feeds selected should always be the maximum compatible with the machine's capabilities and the workpiece requirements. In many cases, the recommendations exceed recently established practice, but the tabulated recommendations have all been attained, both in tests and in production runs.

Not all situations can be provided for by a table. Observation of machining results should generally indicate whether one or more of the controlling factors on the chart should be increased or reduced. However, by challenging the "generally accepted method," the table offers an opportunity for sharply increased productivity.

Turning with Carbide Throwaway Inserts

Work Material	Type of Cut	Depth of Cut (in.)	Feed Range (in.)	Speed (fpm)	Insert* Grade	Holder Type	Coolant Type
Free-cutting	Interrupted	1/4-5/8	0.015-0.030	180-375	K21 (370)	Negative	Soluble oil
and carbon	Roughing	7/32-3/8	0.012-0.025	375-550	K21-K4H (370)	Neg-Pos.	Soluble oil
steels (1006-	General use	1/8-3/16	0.009-0.015	500-700	K4H (350)	Neg.-Pos.	Soluble oil
1050, 1109-1213)	Finishing	1/64-3/32	0.005-0.008	600-900	K7H (350)	Positive	Soluble oil
Alloy steels	Interrupted	1/4-5/8	0.015-0.030	100-250	K21 (370)	Negative	Soluble oil
4130-4340 etc.	Roughing	7/32-3/8	0.012-0.020	250-375	K21-K4H (370)	Neg.-Pos.	Soluble oil
& stainless	General use	1/8-3/16	0.009-0.015	350-500	K4H (350)	Neg.-Pos.	Soluble oil
403 to 502	Finishing	1/64-3/32	0.005-0.008	450-700	K7H (350)	Positive	Soluble oil
Stainless steel	Interrupted	1/4-1/2	0.015-0.030	70-140	K21 (370)	Negative	Soluble oil
18-8 type	Roughing	7/32-3/8	0.012-0.025	160-300	K21-K4H (370)	Neg.-Pos.	Soluble oil
201 to 350	General use	1/8-3/16	0.009-0.015	300-425	K4H (350)	Positive	Soluble oil
(Austenitic)	Finshing	1/64-3/32	0.005-0.008	400-550	K7H (350)	Positive	Soluble oil
Cast iron	Roughing	7/32-1/2	0.020-0.040	180-350	W21 (370)	Negative	Dry
	General use	1/8-3/16	0.013-0.025	350-450	K21-K4H (350)	Neg.-Pos.	Dry
	Finishing	1/64-3/32	0.005-0.012	425-600	K7H (350)	Positive	Dry
Aluminum &	Roughing	5/16-5/8	0.020-0.040	350-750	K21 (370)	Positive	Soluble oil
Magnesium	General use	1/8-1/4	0.010-0.025	750-2000	K4H (350)	Positive	Dry
Titanium	General use	1/8-7/32	0.012-0.020	180-300	K4H (370)	Positive	Soluble oil
Alloys	Finishing	1/64-3/32	0.008-0.012	300-400	K7H (350)	Positive	Soluble oil
Brass &	General use	5/32-1/4	0.012-0.020	450-700	K4H (370)	Neg.-Pos.	Dry or
Bronze	Finishing	1/64-1/8	0.006-0.012	600-900	K7H (350)	Positive	Soluble oil
"K" & "S" monel	General use	1/8-7/32	0.010-0.020	200-350	K4H-K21 (370)	Neg.-Pos.	Soluble oil
& monel	Finishing	1/64-3/32	0.005-0.010	300-450	K7H (350)	Positive	Soluble oil
Inconel	General use	1/8-7/32	0.008-0.015	100-200	K4H-K21 (370)	Positive	Soluble oil
	Finishing	1/64-3/32	0.004-0.008	180-300	K7H (350)	Positive	Soluble oil
Inconel-X	General use	1/8-7/32	0.008-0.015	70-120	K4H-K21 (370)	Positive	Soluble oil
	Finishing	1/64-3/32	0.004-0.008	100-200	K7H (350)	Positive	Soluble oil
Nonmetallics	General use	1/8-1/4	0.009-0.015	400-650	K4H (370)	Positive	Dry
Fiber class	Finishing	1/64-3/32	0.004-0.008	550-900	K7H (350)	Positive	Soluble oil

*Equivalent grade denoted by parenthesis.

news

Who travels "A Mile for Every Member"? See page 104.

astme in action

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Host Committee Plans Production

WITH ALL THE PRECISION and acumen required for production planning, fourteen New Yorkers are currently preparing for an outstanding five-day production—the 1961 ASTME Convention.

The fourteen planning experts are the New York Host Committee, thirteen men and one woman, who will be throwing out the welcome mat next May for some 40,000 engineers and manufacturing executives attending the Society's Tool Exposition and Engineering Conference. For months these planners have been hard at work weaving their welcome mat with special activities for the ASTME conventioners.

Working in conjunction with the National Program Committee, the New York hosts and hostess are mapping out tours of local industry, lining up chairmen and managers for high-powered technical sessions and arranging an attractive schedule for the feminine contingent at the conference. Already on tap for the ladies is a visit to the Brooklyn Navy Yard where they will see the launching of an aircraft carrier. Other plans of the host committee include a Long Island Day program to be held at Grumman Aircraft Engineering Corp. The topic of the day will be high-energy metalworking.

New York Gala Predicted

With understandable civic pride, the committee promises convention visitors an exciting time in a truly exciting city. East Side, West Side, New York offers countless attractions in the worlds of entertainment, industry and culture. The teeming metropolis is the seat of international finance, the home of many great corporations and the center of world commerce and trade.

At the head of host committee operations is a man quite familiar with production planning and responsibility. Dominic R. Scolaro, chairman of Greater New York chapter and member of the National Program Committee, is product chief of the large, tower type Air Defense warning radar systems at Sperry Gyroscope Div., Sperry Rand Corp. In this position he coordinates the engineering, design and manufacture of the multimillion-dollar radar systems and frequently acts as a consultant on the development and manufacture of new electromechanical products.

Scolaro's committee is comprised of twelve Greater New York members who are hosting in the following capacities: Joseph Papa, secretary; Gerald Abbott, treasurer; William F. Reber, vice chairman of technical activities; Louis Wertman, technical sessions chairman; M. Milton Tanenbaum, plant tours chairman; Oscar Schwartz, transportation chairman; Sol Frederick Seeman, emergency chairman; Carl Kertesz, vice chairman of supplementary activities; Alfred M. Sampter and Joseph F. Ferran, publicity chairmen; Richard R. Montana, tickets chairman; and Jacob H. Sperman, reception chairman. The hostess in the group is Mrs. Carl Kertesz, ladies' activities chairman.

Backed by the New York skyline, these four host committee members stand ready for the 40,000 conventioners who will descend on their city next May. Left to right are Jacob H. Sperman, reception chairman; Mrs. Ida Kertesz, ladies' activities chairman; Carl Kertesz, vice chairman of supplementary activities; and Dominic R. Scolaro, general chairman.

Departing from his office in Chicago, national President H. Dale Long is off again on ASTME business.

A Mile for Every Member

IT IS A SMALL WORLD indeed for H. Dale Long. From New York to California, from Mississippi to Wisconsin, no distance daunts the ASTME president if it entails service to the Society.

When Long's term of office expires next May, he'll have traveled an ASTME mile for each member of the nearly 41,000-strong Society—and have enough spare mileage to accommodate any rise in membership these next two months may bring.

At the end of 1960 the presidential speedometer read 21,850 miles. The territory covered ranged from committee meetings and on-campus conferences to chapter charterings, Tool Engineers Days and anniversary meetings to a host of other local, regional and national ASTME events. The 1961 schedule promises to add another 19,600 miles—many of which have already been traveled—for a total of 41,450 miles. And, notes Long, there are bound to be additional trips not presently on his schedule.

All this ASTME mileage has acquainted the Society president with a good many of the nation's airports, large and small. On the cover of this News Section, he is pictured at the Memphis airport, waiting for a homeward bound flight.

But it's those cities in which the airlines use more than one airport that spell trouble, he smiles. Of those cities, Chicago is the most recent confusion-causer. Long was scheduled to return from a flight to Hamilton, Ont., at O'Hare field. Naturally, he assumed that the plane would also leave from the same field. But on arriving at O'Hare with a bare minimum of time to waste, he found, much to his chagrin, that the flight left from Midway airport, too many miles away.

Another of Long's harrowing travel experiences occurred on a return trip from Rochester, N.Y. The plane hit a massive cold front over the east end of Lake Erie and fell for several thousand feet in a frightening down draft. Everything that wasn't fastened down—including people—ended up at the top of the plane. For all the passengers knew, it *was* the end. "Finally," said Long, "we pulled out of the down draft thousands of feet lower, with the inside of the plane looking like a cyclone had hit it."

However, in Long's estimation, the purpose of his widespread travels far outweighs the little inconveniences they may involve. At his installation into office last April, he pledged "to advance the knowledge and the practice of manufacturing technology and know-how." That pledge is what has taken him thousands of miles to give hundreds of talks with these specific objectives:

- To get top management in industry to understand the scope of the tool and manufacturing engineering function and the importance of the men who perform that function.
- To get ASTME members and their wives to understand the importance of the tool and manufacturing engineering function and how the Society helps members keep up with manufacturing technology.
- To get ASTME members to attend meetings and other Society activities, learn about the latest manufacturing technology and apply what they learn to beat local and foreign competition.

In his visits to various ASTME groups, Long has noted the progress being made in planning programs for the chapter year and in suiting the programs to the industry and membership needs of the areas. He also reports that across the nation the Society "enjoys a reputation for action, progress and accomplishment."

What does Mrs. Long think of this extensive traveling? "She likes ASTME people just as I do," says her husband, "and she would like to accompany me more often, but it is difficult to get away from our big family." The Longs have a family of eleven children.

And the younger set among these eleven are quite familiar with their dad's attache case. The sight of it never fails to draw, "Where are you going now, Daddy?" "When will you be home again?"

Long himself sums up ASTME travel as "the rewarding experience of meeting the many dedicated individuals who are playing key roles in the Society's international program, which is advancing manufacturing know-how and technology as well as giving the peoples of the world more and better values in material products."

director nominees named by petition

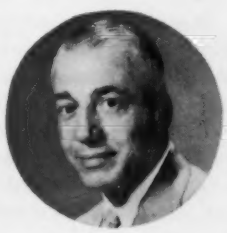
PETITIONS signed by 20 or more ASTME members have added three men to the present list of nominees for the 1961-62 Board. This brings the total of director candidates to 22. In accordance with National Procedures, nominating petitions must be presented to the National Office before Feb. 1 to be included on the printed ballots for the House of Delegates.

At the Annual Meeting in New York next May, the House of Delegates will elect 14 national directors. The retiring president, H. Dale Long, automatically becomes the 15th member of the Board.

Sketches of the 19 nominees named by the Annual Nominating Committee last fall appear in the January issue of THE TOOL AND MANUFACTURING ENGINEER. Those candidates nominated by petition are:

Ralph Lewis Chrissie joined the Society in 1939 as a charter member of South Bend chapter. In '41 he became a member of San Diego chapter and later transferred to the Los Angeles ASTME group, of which he is a past chairman. He has spent three years on both the National Program and Membership Committees and since 1957 has served as Los Angeles chapter entertainment chairman. Now sales engineer at the Arrowsmith Tool & Die Corp., Los Angeles, Chrissie was previously president of Hollywood Mfg. & Supply. Prior to that, he was supervisor of tool design at Northrop Aircraft.

Frederick Preator has served eight years on the National Education Committee and is presently a consultant to that group. Professor and head of the tool and manufacturing engineering department at Utah State University, Logan, Utah, he pioneered and developed the curriculum offered by this department of the university. He is a member of Ogden chapter. Listed in "Who's Who in the West," Prof. Preator attended Birmingham Technical School in Great Britain and is a member of the Institution of Production Engineers. He holds a B.S. degree from Utah State University and an M.S. degree from Wayne University.



Charles M. Smillie, past national treasurer and secretary, is presently completing his sixth term on the Board of Directors. He has served on the National Membership, the Name-Change and the Officer Nominating Committees. Smillie, who is president of Products Supply Co. and C. M. Smillie & Co., Ferndale, Mich., helped organize and for two years chairmanned the Professional Engineering Committee. He is a past chairman of the Detroit chapter and has served on the Board of the National Screw Machine Products Association. Since 1955 he has headed the Michigan Advisory Council of Scientists and Engineers for Selective Service. He is also active on the NAM defense committee.

Society Urged To Study Tomorrow's Engineer

WHAT will the tool and manufacturing engineer be required to know and do in 1970-75?

Both the National Education Committee and the Research Fund Committee have discussed this question in recent months, along with the feasibility of an organized examination of possible answers. Most recently, at its last meeting held at Scully-Jones and Co. in Chicago, the Research Fund group went on record as approving a Society-sponsored effort to find out what the 1970 tool and manufacturing engineer will be like, and urged that the National Board of Directors approve the project.

The committee further recommended that the Board assign the investigation to the proper Society committee. It offered the services of its members and of Research Director Leslie S. Fletcher in helping administer the project. However, they noted that "the subject matter may well be considered as the field of the National Education Committee."

"The tool and manufacturing engineer has an ever-changing job, and there are strong indications that his job is becoming increasingly complex," Fletcher said. "It therefore would seem to be practicable for ASTME to ferret out valid information on what his duties will be in years hence, to furnish a guide to the proper education of new tool and manufacturing engineers and for the training and professional development of young practicing engineers."

Society President H. Dale Long explained the content and implications of the Long Range Planning Committee report as it affects research. He declared that in essence the Society's obligation to its members was to *provide basic funds of knowledge* on pertinent fields of tool and manufacturing engineering. Such knowledge, he said, should be the type that can be *applied* by the many members in the know-how rather than the know-why category.

"The intent of the Board of Directors in approving the long-range plans," Long continued, "was for the Society to sponsor research that is not being done by private industry—research that will benefit ASTME members, and through them benefit industry and society in general."

In other actions, the Research Fund Committee accepted with regret the resignation of Gervais W. Trichel, who has been assigned to France by Chrysler Corp.'s Defense and Special Products Div., and prevailed on Joseph Sunnen, of Sunnen Products Co., St. Louis, to withdraw his resignation.

March Ides and Ideas

SHAKESPEARE has been edited at 10700 Puritan Ave. Instead of "Beware the Ides of March," it's "Be Aware of the Ideas of March. . . ."

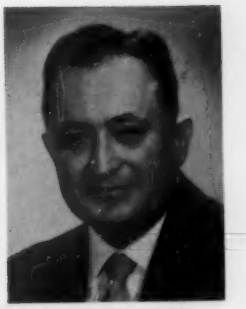
March 15, to be exact—a Very Important Day when a very special issue of the TME will be published. It's very special because it has been prepared especially for you, to answer your special questions concerning product and production planning by giving you the quickest and easiest way of obtaining engineering and source information.

Many months have passed since work on this issue began. Months were spent revising a master mailing list of manufacturers and making a new and more inclusive product list.

Mailings began to go out and come in, by the bagful: follow-up letters were sent to companies who remained unheard from; duplicate packages and additional forms were forwarded to those who needed them. Telephone calls and telegrams flashed between editorial personnel and manufacturers; space became a premium as stacks of forms grew higher and higher. From Abrasive Bands to Zirconium each company was listed under the one or one hundred products it manufactures.

Editing and proofreading consumed winter days. Mistakes were remedied, proofs are even now being read, pages planned and pasted up . . . .

On March 15, the completed magazine will be in your hands. In one issue, along with regular features, you will have an ordered compilation of over 2250 manufacturers, their 1490 products and a seemingly endless list of sales outlets. All for you, at your finger tips, the most extensive source of manufacturing and engineering information in the metalworking field in the March 15th issue of THE TOOL AND MANUFACTURING ENGINEER.



Irving H. Buck

Director Buck Dies; Cervenka Fills Vacancy

NATIONAL DIRECTOR Irving H. Buck, 54, died in Dallas after a heart attack Jan. 15. He was board chairman of the Tool Supply and Engineering Co. and president of Machine Tool Sales Co., both of which he had founded.

Designated to fill Buck's unexpired term as director was Arthur Cervenka, consultant to the National Constitution and Bylaws Committee and member of Long Island Chapter 88. He was sworn in by Vice President William Moreland at special ceremonies in the Dearborn Inn, Dearborn, Mich., a week after Buck's death.

Cervenka becomes director by virtue of his having received the highest number of votes among those candidates for the Board not elected in last spring's balloting by the House of Delegates. His "election" was the result of a carefully worked out procedure set up for such emergencies but never before carried out in the Society. The fact that he was the runner-up choice of the House of Delegates was not known—not even to national officers in the Society—until a safe containing the sealed ballots was opened at Headquarters in Detroit.

Buck had been on the National Board of Directors since 1955. As a director, he had served two years on the Long Range Planning Committee which gave its final report at the Los Angeles semiannual meeting last fall. The quiet, likable engineer was a charter member of North Texas Chapter 51 and had served the group three terms as chairman. He was instrumental in the formation of several other ASTME chapters in the south and southwest, including San Antonio, Oklahoma City, Little Rock, East Texas and Mississippi. During four years on the National Membership Committee, Buck had been its vice chairman and area captain.

A Dallas resident for almost 30 years, Buck was a native of Fond du Lac, Wis. He had been active in Dallas-area youth organizations and Little League teams. In addition to his executive positions in two machine tool distributor firms, he was on the board of the Great Southwest Life Insurance Co. He was a member of the Engineers Club of Dallas, the American Machine Tool Distributors Assn. and the Chamber of Commerce. A brother, Clarence W. Buck of Fond du Lac, survives.

At a special ceremony in Dearborn, Mich., Vice President William Moreland (left) swears in Arthur Cervenka (center) as a member of the ASTME Board. Looking on is Vice President Frank F. Ford.

Cervenka is manager of equipment and process engineering at Grumman Aircraft. Prior to his present role as consultant to the National Constitution and Bylaws Committee, he had served the group as member, vice chairman and chairman. He is also vice chairman of the National Finance Committee and, like Buck, had been a member of the Society's Long Range Planning Committee.

A graduate of Columbia University, Cervenka holds a committee chairman's seat in the ASA and is a past chairman of Aerospace Industries Association's manufacturing equipment committee.

Smiles of pride were the order of the evening at the recent chartering of Detroit Engineering Institute student chapter. Displaying the charter are (left to right) F. E. Lamb, vice president of DEI; Charles M. Smillie, ASTME director; Joseph Gabrick, first vice chairman of Detroit chapter; Robert Nauth, president of DEI; and Frank Weaver, chairman of the newly formed DEI student chapter.

Student Chapter 33 Chartered

DETROIT—On Jan. 25, 25 young men from the Detroit Engineering Institute entered the Society ranks as the 33rd student chapter in the country and the third ASTME student group in Detroit.

Some 50 persons—including delegations from the mother chapter, Detroit, and from the first Canadian student chapter, Western Ontario Institute of Technology in Windsor—turned out to launch the new chapter and encourage its members in their enthusiasm for the tool and manufacturing engineering profession. As chartering officer, Charles M. Smillie, national director of ASTME and president of the C. M. Smillie Co., welcomed the students into the Society. In a challenging talk entitled "Where Do We Go from Here," he explained the important responsibilities and opportunities that are a part of identification with and participation in an organization such as ASTME.

The charter for Student Chapter 33 was presented to Robert E. Nauth, president of Detroit Engineering Institute and faculty adviser to the newly formed ASTME group. Nauth, who is currently a member of the National Technical Publications Committee's textbook subcommittee, is largely responsible for the formation of the DEI student chapter.

At the chartering ceremonies F. E. Lamb, vice president of DEI, acted as toastmaster and Joseph Gabrick, first vice chairman of Detroit Chapter 1, presented the membership kit. Gilbert Seeley, national director of education, presented a check from the Society to the student treasurer, Timothy Czach. Other student officers installed at the charter meeting are: Frank Weaver, chairman; Patrick Wren, first vice chairman; Peter Swanney, second vice chairman; and Richard McAlpine, secretary. Chairman Weaver announced that the chapter's first meeting would be held on Feb. 8.

On-Campus Conference Scheduled at Denver

DENVER, Colo.—Management, engineers, educators and students will converge on the University of Denver on March 4 for the 1961 annual On-Campus Conference of Denver Chapter 77. Titled "Trends in Manufacturing," the day-long event will feature sessions on metal fracture, metrology for the space age, plastic tooling and ultrasonics in cleaning and welding.

The conference speaker roster includes Donald Peckner, associate editor of *Materials in Design Engineering*, New York; Glen L. Stimson, chief engineer at Greenfield Tap & Die, Greenfield, Mass.; Lloyd J. Oye, marketing director at Rezolin, Inc., Santa Monica, Calif.; and Benson Carlin, vice president of Circo Ultrasonic Corp., Clark, N. J. Luncheon speaker William T. Stanger, chief engineer at Ball Brothers Research Co., Boulder, Colo., will talk on the "Costs of Engineering Errors." All technical sessions will be held at the university's Student Union Building. —*Alan T. Montgomery*

Chapter 88 Offers Plastics Course

LONG ISLAND—Receiving certificates of completion for Chapter 88's lecture series on plastics technology are Emanuel Schaarschmidt (center left), Grumman Aircraft, and his son Paul (center right). The course was presented on the campus of the Long Island Agricultural and Technical Institute, Farmingdale, N. Y., by the plastics section of the chapter. It consisted of five sessions of lectures and demonstrations, given by experts in the field and designed to familiarize both lay people and specialists with the entire broad plastics area. A total of 85 students, teachers and guests attended the classes. ***—H. O. Sjoman***

Explosive Forming Discussed at Seattle

SEATTLE, Wash.—These explosively formed parts are stirring up interesting comment among members of Chapter 39. Eric Stone (second from the right), who spoke on "Explosive Forming," shows the panels to (left to right) Chairman Carl Carlson, P. A. Kruse, Dick Lingen and Cliff Kelley. ***—Ray Clift***

News Editor Resigns

M. L. (Mel) STONE has resigned his position as news editor of THE TOOL AND MANUFACTURING ENGINEER to become administrative assistant to the general manager of the *Philadelphia Inquirer*, Philadelphia, Pa. Before joining the TME staff in December 1957, he was associated with the *Detroit News*, the *Louisville Courier-Journal* in Kentucky and the *Little Rock Gazette* in Arkansas.

During his three years as news editor, Mel became known throughout the Society by his frequent news-gathering visits to chapter meetings and other ASTME events. Among his many contributions to the magazine is a series of ASTME-member profiles. In announcing the resignation, TME Editor John W. Greve said: "Mel has done an outstanding job as news editor and has achieved considerable success in raising the stature and increasing the readership of the magazine."

Canadian Official Dies; Honorary Member

C. D. Howe

MONTREAL, Que.—C. D. Howe, an honorary member of the Society and for more than two decades one of Canada's top governmental officials, died of a heart attack here Dec. 31. He was 75.

The American-born engineer entered government service in 1935 with his appointment by Prime Minister MacKenzie King as Minister of Railways. After helping rebuild the debt-ridden national railway system, he served Canada as munitions chief during World War II. In postwar years, until his retirement in 1957, he was Minister of Reconstruction and of Trade and Commerce.

Howe was banquet speaker at the Society's last "big" semiannual convention, held in Montreal in October 1949. He became an honorary member of the Society at the Chicago convention in 1952.

Tucson Schedules Space-Age Seminar

TUCSON, ARIZ.—Chapter 106's second annual seminar on space age tooling and manufacturing will be held on the campus of the University of Arizona April 14-15. Theme of the conference, jointly sponsored by the chapter and the university, is "Aerospace Manufacturing Technology."

Tentative session topics are aerospace materials and their properties; machinability of aerospace materials; microprecision removal of metal; fabrication techniques for lightweight structures; use of controls in advance tooling; and a review of the status of tool engineering.

Technical sessions will be in the university's Physics and Math Building. A dinner meeting and a luncheon have been arranged, as well as a special program for wives. —*Frank F. Netti*

Nashville Will Cosponsor Management Conference

NASHVILLE, Tenn.—On Mar. 4 the Nashville chapter of ASTME will cosponsor a Spotlight Management Conference with the local groups of the Society for Advancement of Management and the National Association of Accountants. Approved by the National Management Association, the one-day conference is being promoted by the Avco Management Club, Avco Corp., Nashville.

National Vice President Frank F. Ford will be moderator for the conference's tool and manufacturing engineering panel session, "Management's Investment in Tool and Manufacturing Engineering." Some 300 persons are expected to attend the day-long event. —*L. H. Kelley*

Senator Is Toastmaster At Hartford Meeting

HARTFORD, CONN.—Senator William A. Purtell of Connecticut, an early member of ASTME, acted as toastmaster for the recent annual Hartford Executive and Educators Night. Three hundred members and guests attended the meeting, which recognizes industry's contributions to the educational program of Chapter 7. Affiliate memberships make possible six scholarship awards annually, valued at $1200.

Sidney A. Edwards, managing director of the Connecticut Development Commission, described the function and operation of his group as developing the state's assets. Among these assets, he said, are members of ASTME.

Hartford members recently toured the Brown & Sharpe Precision Center. —*J. D. Flannery*

special events

ASTME Seminar "Die Design & Press Tooling"	Mar. 2-3 1961	Conrad Hilton Hotel Chicago, Ill.
On-Campus Conference	Mar. 4 1961	University of Denver Denver, Colo.
ASTME Seminar "Plastic Tooling"	Mar. 15-16 1961	Statler Hilton Hotel Detroit, Mich.
ASTME Seminar "High Energy Rate Forming"	Mar. 29-30 1961	Sheraton Hotel Philadelphia, Pa.
"Aerospace Manufacturing Technology Seminar"	April 14-15 1961	University of Arizona Tucson, Ariz.
ASTME 29th Annual Meeting	May 20-26 1961	Statler Hilton Hotel New York City
ASTME 1961 Tool Show	May 22-26 1961	New York Coliseum New York City

Reports in Brief . . .

Canada

Principal speakers at a recent meeting of the WINDSOR chapter were two executives of the N. A. Woodworth Co. George Hohwart, vice president of manufacturing, spoke on "Power and Precision Chucking Methods." The topic selected by Robert W. Chadwick, vice president of sales, was "Dollars and Sense," an approach to workholding tool procurement. . . . GRAND RIVER VALLEY chapter and the Canadian Welding Society were recently guests of the Engineering Institute of Canada for a meeting on stainless steel. The chapter's January meeting drew 249 members and guests for The DoAll Co.'s presentation of "The Story of the Cutting Edge."

Southwest

A large crowd of ALBUQUERQUE chapter members turned out to hear national Vice President David A. Schrom speak on "Productivity Versus Nonproductivity" at their monthly meeting. "The United States, as the greatest character nation in the world," said Schrom, "must foster better understanding between management and production workers to maintain and continually improve our heritage."

Midwest

CANTON chapter members were recently informed of the latest developments in gaging applications by A. P. Wright, representative of The L. S. Starrett Co., Athol, Mass. At the same meeting the nominating committee for the approaching chapter election was appointed. . . . In a talk before KALAMAZOO chapter, William J. Jabsen, metallurgist and sales manager at Kalamazoo Steel Process, Inc., traced the history of heat-treating.

positions wanted

PRODUCTION MANAGER OR MASTER MECHANIC—available. College graduate, experienced automotive, aircraft, diesel and missile components (production engineering field). Twelve years aircraft tooling and processing for production. Complete knowledge of machine tools, methods, time study, experimental, prototype and toolroom manufacturing. Capable of directing these activities. Write to Classified Ads, Dept. 199, 10700 Puritan Ave., Detroit 38, Mich.

TOOL DESIGNER (Scotch, 25), emigrating to U.S. seeks position. Light and medium engineering experience. Write to Classified Ads, Dept. 198, 10700 Puritan Ave., Detroit 38, Mich.

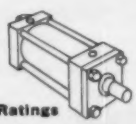
EXPERIENCED DIEMAKER, designer, vast knowledge of all phases of work with large and small automotive dies. Early thirties. Would prefer Northern Ohio. Write to Classified Ads, Dept. 197, 10700 Puritan Ave., Detroit 38, Mich.

THIS...IS WHAT YOU BUY!

POWER — clean, dry, drip-free power at the business end of a Hannifin piston rod is the result of Hannifin extra quality, and at no extra cost. Bores are honed to 15 RMS or finer . . . piston rods are case hardened, plated and polished to 10 RMS or better. Cartridge gland, removable without dismantling cylinder, has exclusive Hannifin-developed "Lipseal®-Wiperseal" combination for a truly drip-free rod.

Modern straight thread leak-proof ports for easily positioned fittings are available at no extra cost on hydraulic cylinders.

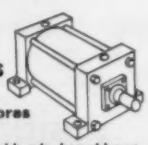
HYDRAULIC CYLINDERS



Two Pressure Ratings

2000 psi (3000 psi non shock), the famous heavy duty Hannifin Series "H" in 1½" to 12" bore.
1000 psi, Series "L", 1" to 8" bore, Hannifin quality in a lighter cylinder. Full compliance JIC Hydraulic Specs.

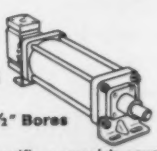
AIR CYLINDERS



1½" to 14" Bores

Series "A"—steel heads, honed brass body for corrosion resistance. Hardened and hard chrome plated piston rod. For all heavy duty air service. Easily modified for water service. Full compliance JIC Pneumatic Specs.

AIR MOTORS



1¾" to 4½" Bores

New from Hannifin, a complete power package combining cylinder and solenoid valve. Only one air line connection. Four mounting styles. Interchangeable mounting dimensions for most applications.

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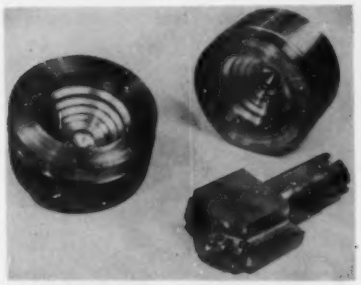
3128-PH

Progress in Production

PINEAPPLE TOOL SPEEDS MACHINING OF BERYLLIUM PARTS

Called pineapple tools because of their configuration, the formed cutting tools developed by Beryllium Corp. for use on turret lathes provide faster, more accurate machining of complex, all-beryllium parts for the aircraft and related industries.

Each tool consists of a high-carbon tool steel shank measuring 2⅞ inches in diameter and a body of the same material. The work end of the tool holds six carbide-tipped cutters set at various rake angles. It can be flat or pointed to 70 deg, depending on whether flat or conical shapes are to be cut.



A 3⅛-inch deep hole was cut in a 5½-inch ID, 1¼-inch thick aircraft part with the pineapple tool at 200 sfm in 45 min.

According to Berylco, the pineapple tool generates only one sixth the heat normally produced when drilling holes in beryllium. Consequently, the risk of creating detrimental quantities of beryllium oxide is reduced and the value of salvaged chips is increased.

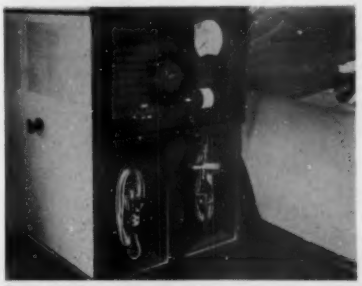
UNIT PINPOINTS ACTUAL AND POTENTIAL ELECTRICAL TROUBLE SPOTS

Although individual components of an electrical system may work before assembly, they do not always work properly after final assembly of the complete system. To catch such malfunctions, Ford Motor Co. is applying the Eager (Electronic Audit GagER), developed by Performance Measurement Co., to all Lincoln Continental automobiles.

The Eager performs three jobs. It reports whether or not an element of the electrical system is functioning, determines how well the element is functioning and predicts future trouble spots on the basis of probability factors. The entire system of an automobile is checked and the findings permanently recorded in 15 min. Previously, at least two hours were required for the same cycle of tests and, by former testing methods, the human error factor of inspection had to be expected and accepted.

The Eager can be located wherever it is needed on an automobile production line. A folding arm with electrical connections clamped to the battery and three other terminals swing out over the car hood at the inspection station. The inspector, conducting all tests from the driver's seat by means of a remote control unit in his hand, observes vehicle operation on a single indicator on the front of the Eager. At the start of each test, a 35-mm film projector displays complete instructions on a screen. The film containing these instructions is a split frame and has a second half which is not visible. This half, through an arrangement of electronic eyes and dot patterns, programs the Eager by telling it what test is to be made and how to perform it. The visible half of the film superimposes the acceptable measurement limits on the indicator. Depending on this indicator reading, the inspector will pass or reject the test by sending a signal to the Eager with his remote control unit. Test results are permanently recorded on a printed tape and corrections made are verified by the Eager.

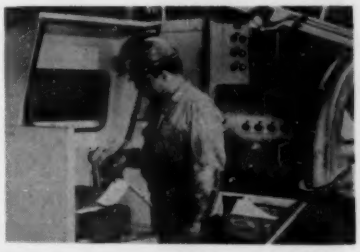
Test films for more than one vehicle can be put on one strip and the total number of components tested by the system can be as high as 339.



Instructions, test parameters and car performance data shown on a screen provide a yardstick for rejects.

COMPUTER TAKES OVER IN STEEL PROCESSING

A digital computer system, believed to be the most complex computer system in the steel industry, is controlling production and quality on the new continuous annealing line at Jones & Laughlin Steel Corp.'s Aliquippa, Pa. Works. The annealing line heat treats strip steel before it is coated with tin to form tin plate, a material used by can manufacturers.



Operator inserts punched card into computer card reader as coil of steel enters annealing line. He records coil number, weight and inventory code on switches at right.

The computer:

1. Plots a method of operation whereby the continuous annealing line can be run at its most efficient speed and with the greatest product quality without abuse of the equipment.
2. Provides accounting records on punched tape for each coil of steel as it emerges from the line.
3. Reduces furnace downtime by checking the various sensory devices within the furnace for off-normal practices or conditions.
4. Provides timely, accurate operating data in typewritten form, enabling operators to make production decisions with a minimum of interpretation.
5. Provides increased knowledge of the continuous annealing process, which will permit better design in future annealing lines.
6. Possesses the capability of being reprogrammed to match advances in the art of annealing and in computer control.

The complexity of this computer, designed and built by General Electric, is due to the many variables in the an-

modern MACHINES *demand*

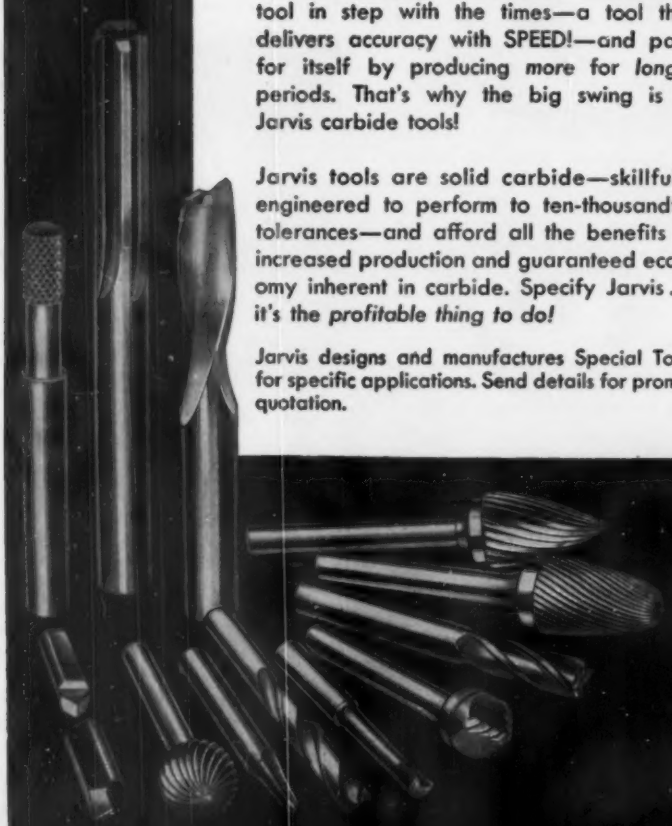
MODERN *solid carbide* **TOOLING!**

Jarvis SOLID CARBIDE GIVES MAXIMUM EFFICIENCY AND ECONOMY!

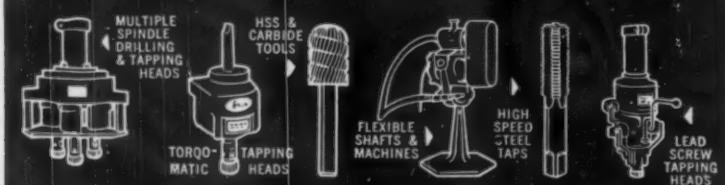
Forward-thinking management demands a tool in step with the times—a tool that delivers accuracy with SPEED!—and pays for itself by producing *more* for *longer* periods. That's why the big swing is to Jarvis carbide tools!

Jarvis tools are solid carbide—skillfully engineered to perform to ten-thousandths tolerances—and afford all the benefits of increased production and guaranteed economy inherent in carbide. Specify Jarvis... it's the *profitable thing to do!*

Jarvis designs and manufactures Special Tools for specific applications. Send details for prompt quotation.



NOTE: SOME AREAS ARE OPEN FOR REPRESENTATIVES OF OUR SOLID CARBIDE TOOLS



JARVIS CORPORATION • MIDDLETOWN, CONNECTICUT

Use Reader Service Card, CIRCLE 62

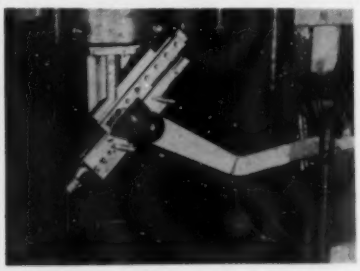
nealing process. Most industrial computers control only one or two variable factors.

The computer can recognize abnormal conditions or failures, not only in the line but also in its own performance. Periodically, it performs a series of programmed calculations, exercising as many of its components and elements as possible. The resulting signals are checked against known correct values to determine any discrepancies. The computer also examines for reasonableness, signals from the various sensing devices. An alarm is sounded if any of the sensing devices transmits an unreasonable signal.

The final protective program is known as a "mad man" sequence. It checks against the possibility that the computer may perform illogical operations and lose the ability to check itself. If this check is not made, a lock-out relay is energized and the computer is automatically shut down.

TRACING SIMPLIFIES CONTOUR MACHINING

Machining of contoured parts up to 12 ft in diameter has been made into a relatively simple operation at the Kinco Inc. plant in Montebello, Calif. Handling this work is a Niles Bement Ponds



Hydraulic tracer machines 98-inch-diam spin chuck in one continuous pattern without resetting.

144-inch vertical boring mill with a Mimik 3000 series hydraulic tracer which is capable of turning all types of spherical radii and irregular contours.

The tracer is interchangeable when needed with a 100-inch mill. It is actuated by a sensitive 6-oz-pressure stylus and hydraulic valve which follows the template. Its stroke is eight inches. There is no limit to the workpiece size since the stroke is increased indefinitely without interruption by engaging the machine feed, which is set along the mean path of the contour, the tracer itself absorbing the contour. Kinco officials say that they are able to hold exacting tolerances and finishes on large contoured surfaces by this method.

TOOLS of today

Unit Wrings Oil from Chips

By running metal chips, turnings, grindings and borings in this chip wringer, 90 to 99 percent of the coolant or cutting oil remaining in the chips after machining is removed. As much as 2.94 gal of oil—more than can

be removed in 12 to 24 hr with a settling tank—can be reclaimed in less than three minutes. The unit has a sheet iron, dynamically balanced basket; a self-balancing spindle; and an automatic spindle oiling device.

Olson Filtration Engineers, Cincinnati 12, Ohio. **Circle 401**

Extra-Length Drills for Deep Holes

This line of high-speed steel extra-length drills was designed for reaching hard-to-get-at and deep holes. The line includes drills of both straight and taper shank styles and in both wire gage and fractional sizes. Diameters range from No. 52 wire gage to 1½ inches. Over-all lengths to 23½ inches are available.

Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich. **Circle 402**

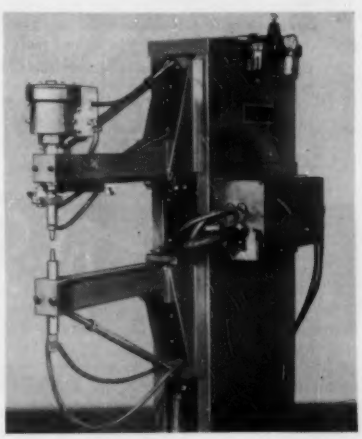
Optical Comparator Sets Tool Depth

Primarily used to set tool depth and diameter in adapters ready for use in numerically controlled machines or other machine tools requiring fast and frequent tool changes, the optical tool setting comparator is also capable of checking tool runout and cutting edge condition on any type of cutting tool. An interchangeable adapter enables it to handle both straight or tapered tool shanks. Maximum depth capacity is 12 inches; diameter capacity is 6 inches. It uses a set of gage blocks and end measures for even inch settings whereas increments of an inch are set by a micrometer head.

Pratt & Whitney Co., Inc., West Hartford 1, Conn. **Circle 403**

Spot Welder Components Are Interchangeable

Operating on 80 psi line pressure, this spot welder has a maximum clamping force of 1950 lb and a complete lubricator, strainer and pressure system. The air valve is integrally mounted with the 5-inch double-acting cylinder. Unusual versatility of use is achieved by interchangeable transformers, available in a range from 20 to 75 kva. Spot welding of aluminum is possible by using a high-voltage transformer. The sealed tubular construction of the upper arm provides a surge tank which in turn enables fast recovery of the air cylinder for consistent rapid stroke



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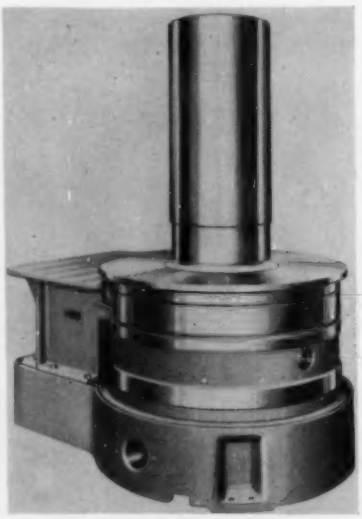
action. Work thicknesses can range from 22 gage to ⅛ inch. Throat depth is adjustable from 12 to 36 inches and throat height is variable from 12 to 18 inches.

Viking Products Co., 915 Oakland Ave., Pontiac, Mich. **Circle 404**

Chassis for Turret Indexing Machines

Intermittent motion for multiple station operations and a stationary center column for inboard tool mounting are provided by this Series K turret indexing machine chassis. Its 18-inch-diam center post makes the unit especially adaptable for automatic drilling, tapping, reaming, milling, processing and

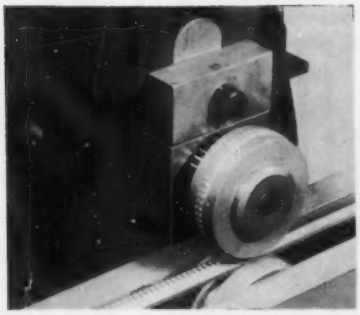


assembly operations. The chassis, available with 6 to 32 work stations and several indexing speeds, is usually furnished with a 43-inch-diam plate. Extensions of the main index camshaft provide a single revolution drive means for actuating operational tooling in synchronization with the main work transfer drive.

Swanson-Erie Corp., 814 E. Eighth St., Erie, Pa. **Circle 405**

Motorized Fixture Speeds Marking

Illustrated is the motorized G-R-D style H fixture—one of 20 varied units for marking products ranging from screw machine stock through aluminum extrusions to special machined parts. This particular fixture is used for continuous marking along the full length



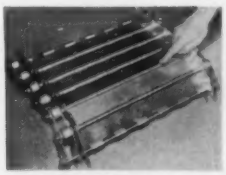
of bar stock for screw machine processing. Lettering is spaced to provide one full symbol or trademark on each finished part. The marking die rotates at 58 rpm, allowing impressions to be made on the bar stock as close as 1/32 inch or as far apart as 1/16 inch. Components of these fixtures include a 1750-rpm, 1/8-hp motor; a solenoid-operated clutch for use in noncontinuous marking operations; a marking roll with any desired symbols or lettering; a T-handle for fine adjustment of marking depth; and a cradle or mandrel for holding parts being marked.

M. E. Cunningham Co., 1025 Chateau St., Pittsburgh 33, Pa. **Circle 406**

USE READER SERVICE CARD ON PAGE 127 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Belting Cuts Conveyor Depth

Over-all section depth of conveyors can be reduced to as little as 8½ inches when this hinged steel belting with ⅛-inch-thick, 2½-inch pitch links is used. The shorter pitch allows the assembled belt to run on sprockets with a pitch diameter as small as 5 inches. Individual links are available in widths to 18 inches. The belting is intended for handling items such as nuts, bolts, stampings and castings which are not

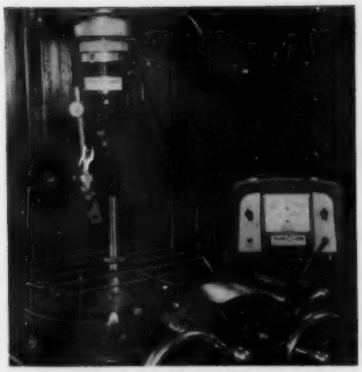


physically big but are heavy in weight. Links with increased clearance between the holes and the through pin are available for water quench or water cooling applications, where corrosive action is often prevalent, and for elevated temperature applications.

May-Fran Mfg. Co., 1710 Clarkstone Rd., Cleveland 12, Ohio. **Circle 407**

Gage Centers, Locates Holes

Accuracy of the Trans-O-Limit centering gage for precise hole locating or centering from a machine tool spindle, including linearity and repeatability, is one percent of full scale equal to ¼ of one division on the scale. Resulting accuracy in the high-magnification range is 0.0000025 inch. It has a radial capacity of 23 inches ID and 19 inches OD; depth capacity is to 15⅛ inches. It consists of a height gage head, slip ring assembly, a gage head support arm and interchangeable



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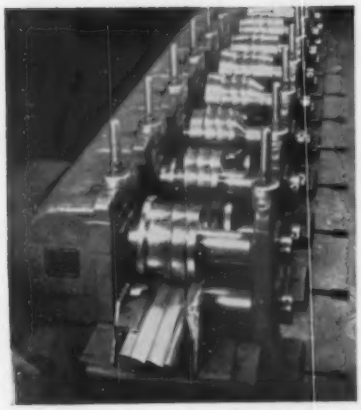

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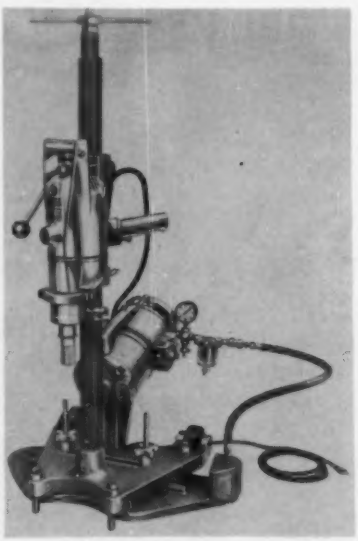
TOOLS of today

arbors for different mountings. Either of two instrument cabinets with different amplifiers are provided. Principle uses of the gage are for accurate positioning and aligning of work on machine tables; checking spindle run-out; and measuring holes, plugs, and bosses for squareness, taper roundness, bellmouth, concentricity and center-to-center distances.

Pratt & Whitney Co., Inc., West Hartford 1, Conn. **Circle 408**

Vacuum Pad Anchors Portable Drills

Used to anchor portable drilling machines, as illustrated, the Truco Tru-Vac vacuum pad permits the drilling machine to be set up with the base parallel to the work or horizontal while



drilling on an incline. The unit consists of a flat aluminum pad resting in a molded rubber gasket which seals it to a floor or wall surface when vacuum is applied. Vacuum is developed by means of an electric motor and pump unit. The standard model develops 1000 lb of vacuum. This is sufficient for drilling holes to 14 inches in diameter in reinforced concrete, tile, marble, brick, etc., vertically or at an angle.

Wheel Trueing Tool Co., 3200 W. Davison, Detroit 38, Mich. **Circle 409**

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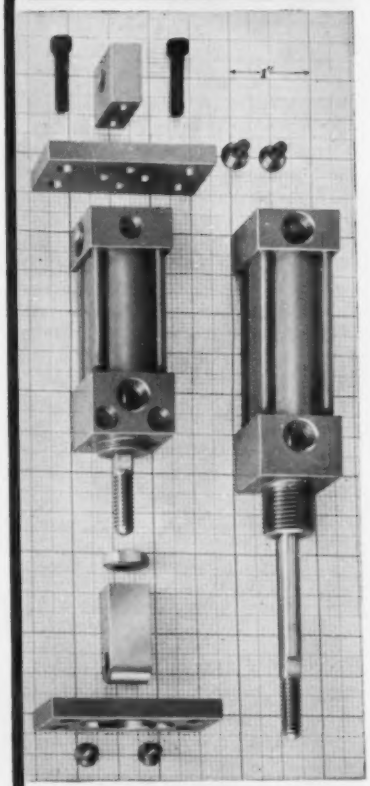
HOW SMALL do you want 'em?



Hannifin offers new "Midget-Air" 200 psi cylinders in ¾", 1" and 1½" bores, double-acting or spring-return. Two basic models, "universal" and "nose-mounting." Universal models come drilled and tapped for mounting, or for use with any combination of the mounting attachments pictured. Delivery is off-shelf in standard strokes, shipment in ten days to specified stroke lengths. Want dimensions and prices? Write:

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Radial Drill Has Greater Rigidity

Designed to fill the gap between sensitive upright drills and large radial drills, this radial drilling machine has, unlike conventional radials, a column which is supported in a housing. This design gives greater rigidity. The radial arm, or ram—available in either 3 or 4-ft length—swings through 360 deg for positioning at any location over the 20 x 40-ft worktable at the front of the machine or, when taller or heavier workpieces are to be drilled, over the 25 x 42-ft work platform at the rear of the machine.

The machine has column and ram power locks. Locked to keep it from rotating, the column can be moved up or down 12 inches in the housing to give 54 inches maximum and 6 inches mini-

mum travel from the spindle to the work surface. The vertical movement of the column provides deep hole drilling to 22 inches. Sixteen spindle speeds in four ranges from 34 to 1640 ipm at any spindle speed are possible with this 5 to 10-hp machine.

I. O. Johanson Co., Skokie, Ill. **Circle 410**

Microminiature Hand Tools Have Interchangeable Tips

Sixty-seven hand tools for microminiature instrument, electronic, laboratory and production use are included in the microTool line. They are supplied in one of three sets—a single kit consisting of one handle and one tip with a replacement tip; a technician's kit consisting of three handles and 23 tips; and a laboratory kit consisting of seven handles and 67 tips. The tips, which embody active elements from 0.001 to 0.01 inch in size, are interchangeable in the tool steel handles. The entire tip area behind the working element is 24-carat gold-plated and shot-burnished to insure corrosion resistance and a contaminant-free tool. Examples of the tip types are needle point, root knife, spade, chisel, graver, manipulator, hook, loop, burnisher, scale, brush, spatula and probe.

Circon Component Corp., Santa Barbara Municipal Airport, Goleta, Calif. **Circle 411**

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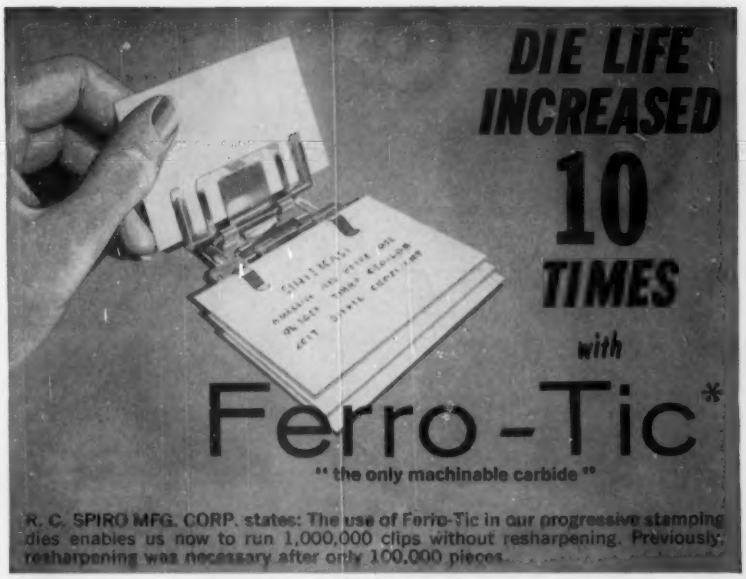
Microwave Oven Cures Plastics, Dries Coatings

Curing plastic parts and drying films and coatings are two applications of the Ther-Monic Radar-Oven. To change from one type of work to another involves only an adjustment of the six-position power output tap switch.

The unit is a microwave generator using a magnetron working into a wave guide with matching stub and then into the heating chamber. Tubeless type resistance heating elements are included in the cavity and separate controls and timers are provided for both micro-



FERRO-TIC combines the fabricating advantages of steel with the wear-resistance of carbide. In the annealed, completely dense state, **FERRO-TIC** can be machined with high-speed tools on conventional tool room equipment; thus, the need for costly diamond grinding is eliminated. Once hardened, by oil quenching from 1750°F, **FERRO-TIC** is extremely hard and wear-resistant. **FERRO-TIC** stock blanks can be fabricated into long-wearing components, using available tools and skill without delay! **FERRO-TIC** is ideal for: Blanking, Lamination, Deep Drawing and Heading Dies, Arbors, Core Rods, Wear Parts, etc. **FERRO-TIC** can be turned, drilled, milled, sawed, tapped . . .

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wave heating and resistance element heating. The tap switch and a power level meter permit adjustment of power so that 100 percent power can be utilized under all conditions.

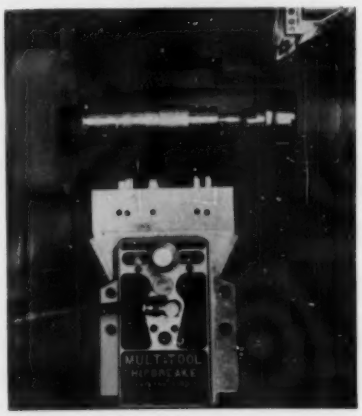
The unit is mounted on casters so that it may be rolled from place to place and the cavity can be arranged to allow running a conveyor through it for heating products on a continuous basis.

Induction Heating Corp., 118 Wythe Ave., Brooklyn 11, N.Y. **Circle 412**

Chipbreaker Boosts Cutting Tool Life

By using the Chipbreaker and Tool Booster on lathes, automatics, planers, shapers or any other multiple or single-point tools for cutting metal, chips are fragmented to the desired size, lengthening cutting tool life. The device operates with a controlled, high-frequency, hydraulically powered, oscillating action which maneuvers the tool cutting edge against the cut and backs it away for clearing and cooling many times per second. The frequency of this motion is adjustable from 25 to 200 cps. The chipbreakers work well when cutting any kind of metal from soft, stringy materials such as copper and aluminum through the range of steels including stainless, and the exotic materials.

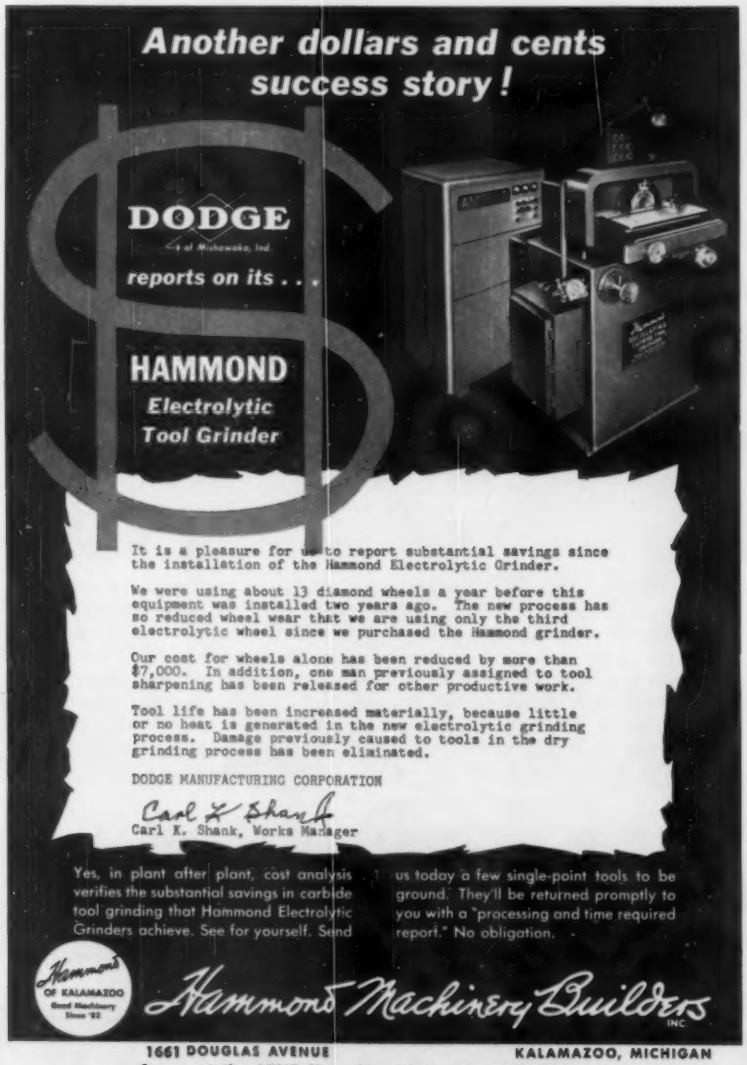
USE READER SERVICE CARD ON PAGE 127 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION



Cleveland Hobbing & Machine Co., 1311 Chardon Rd., Cleveland 17, Ohio. **Circle 413**

Eddy-Current Tester Finds Flaws Automatically

Surface or subsurface flaws in nonferrous, nonmagnetic materials can be detected with this single-frequency nondestructive testing machine. Using oscilloscope presentation, it is adaptable to production line use. Parts from ⅛ to 3 inches in diameter can be inspected at speeds of 50 to 600 fpm. Twenty-four plug-in coils adapt the machine for interim sizes of ⅛-inch increments. The input and power supply panel provides regulation for the 110-volt, 60-cycle, single-phase current and the B+ supply. In this type of tester, a magnetic field induces eddy currents



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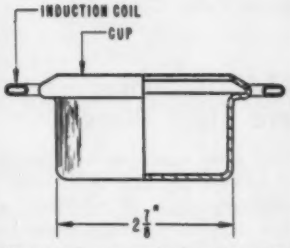
HIGH FREQUENCY *Induction* HEATING UNITS

Lepel induction heating equipment is the most practical and efficient source of heat developed for numerous industrial applications

Typical Induction Heating Applications

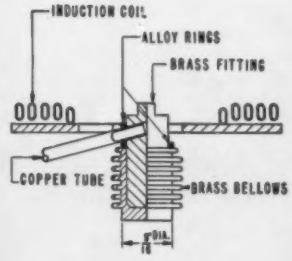
Stainless Steel Cups Selectively Annealed



Flanges of cups made from type 321 stainless steel are selectively annealed by induction heating prior to further forming. Flanges are heated to 2000° F and water quenched. Single-turn coil restricts heating to the flange area.

Our engineers will process your work samples and return the completed job with full data and recommendations without cost or obligation.

Bellows Assembly Brazed



Brass bellows and copper tube are simultaneously silver-alloy brazed to a brass fitting by induction heating. Plate-type induction coil produces proper temperature at each joint.

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in the material being tested. A pickup coil detects variations in the eddy current that indicate flaws.

Magnetic Analysis Corp., 42-44 Twelfth St., Long Island City 1, N. Y. **Circle 414**

Gear Hobber Is Completely Hydraulic

Except for hob and spindle speeds, the Mikron No. 21 fine pitch gear hobbing machine is completely hydraulic. The hydraulic unit controls infinitely variable feeds from zero to 0.006 ips, the hob cycle and the deburring tool. A plunge feed, which is part of the hob cycle and is also infinitely variable, eliminates hob approach. Cutter speeds

are from 400 to 4800 rpm. Both the maximum work diameter and length of cut are 1 1/16 inches. Maximum pitch in steel is 25 diametral pitch and number of teeth is from 60 to 390. The machine can be used as a manual loaded, semi-automatic or fully automatic production machine through a simple tooling change.

Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y. **Circle 415**

Electrolytic Grinder Speeds Drill Sharpening

High-speed steel twist drills are sharpened three to seven times faster with the Ampak electrolytic drill sharpener than with conventional grinders. At the same time, this unit does not generate as much heat as conventional methods do. Drill point angles from 90 to 180 deg, lip relief angles from zero to 20 deg and helix angles from +30 to −30 deg are possible, allowing every mathematical drill point that is practical for drilling metal, fiber, plas-

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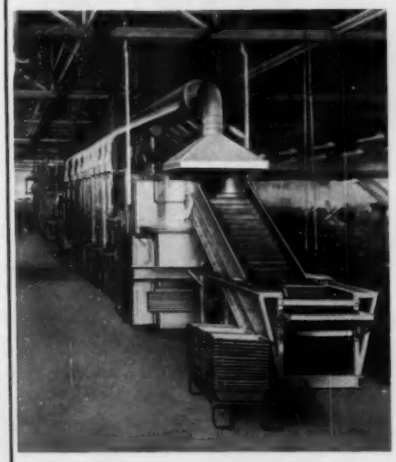
HOLCROFT



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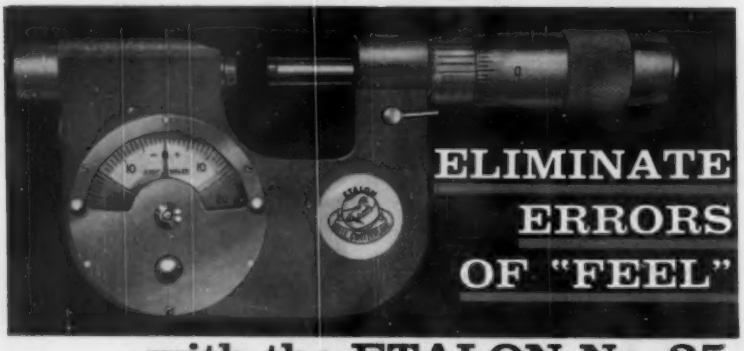

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- Adjustable anvil pressure.
- To simplify fine adjustment, the dial can be rotated so that the "0" may always be placed under the hand.
- Built-in tolerance hands, individually adjustable: red for undersize, blue for oversize.
- Tungsten carbide measuring faces.
- One piece hardened stainless steel screw.
- Retractable anvil.
- Jewelled and shock proof.
- Also available as No. 25 SD with .080" diameter measuring faces and as No. 25 SR with an extra long anvil.

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ALINA CORPORATION

122 East Second Street, Mineola, Long Island, New York

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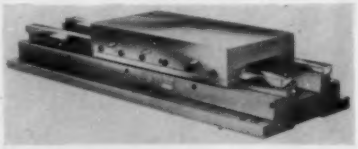
TOOLS of today

tics, wood and other allied materials. Features of the sharpener are a 1-hp motorized 300-amp electrolytic spindle; a self-contained 8-volt, 300-amp, d-c power supply; a constant electronic voltage regulator; and an overload warning system.

Connecticut Special Machine, Inc., Winsted, Conn. **Circle 416**

Slide Assemblies Have Steel Ways

This slide assembly with hardened steel ways is available in 33 sizes with saddle areas from 9 x 9 to 15 x 30 inches. It has a maximum stroke length of 45 inches. Retainer wear strips are mounted under the saddle on each side,



holding the saddle to the base. This construction permits mounting the slide assembly in a horizontal, angular or vertical position. Slide clearance is regulated by means of a bronze gib with adjusting screws.

Russell T. Gilman, Inc., 623 Beech St., Grafton, Wis. **Circle 417**

Unit Uniformly Hardens Surface of Bearing Races

This Model 500 Ther-Monic machine is designed for hardening bearing races. Because the working surface can be heated to 1650 F while the metal 0.02 inch away remains cool, embrittlement of adjacent areas is eliminated. Parts are loaded into the work fixture away from the work coil, then posi-

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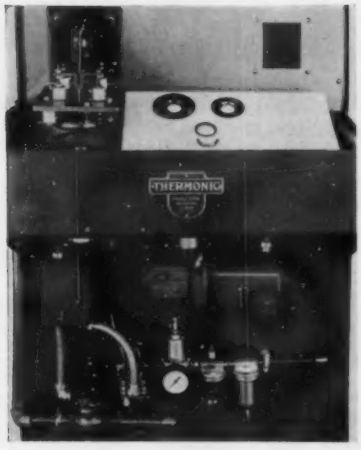


tioned and rotated within the work coil area. The work coil is overhead, permitting introduction of the quench medium from the top at the completion of the 2.2-sec heating cycle. The machine's automatic heat-quench cycle requires 5 kw of rf energy.

Induction Heating Corp., 118 Wythe Ave., Brooklyn, N. Y. **Circle 418**

Redesigned Mill Gives Faster Stock Removal

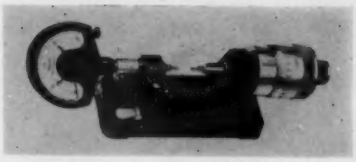
Ball screw leadscrews, nonmetallic ways, a hydraulically counterbalanced working head, electronic overload protection, hydraulic binders, centralized automatic pressure lubrication and welded steel construction are features of the redesigned Kling structural mill. The machine now has a horizontal travel

of 120 inches with a vertical travel of 60 inches. A 40-hp direct drive spindle motor gives 10 inches of infeed. Either 4½ or 5-inch-diam cutters, with carbide inserts, will feed 30 ipm with 1½-hp motor or 60 ipm with a 3-hp motor.

Kling Div., Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio. **Circle 419**

Micrometer Has Interchangeable Anvils

Eleven different types of interchangeable anvils—a total of 40—accompany this indicating bench micrometer for checking small parts. The micrometer has a 1-inch measuring capacity, reading directly in either 0.000050 inch with the Millimess comparator head or 0.000020 inch with the Supramess com-



parator head. The thimble measures directly by 0.0001-inch increments.

A thumb lever built into the base permits rapid retraction of the anvil for inserting and withdrawing the work. Zero adjustment is accomplished by means of a fine adjustment screw outside of housing of comparator head. Two tolerance hands on the outside of

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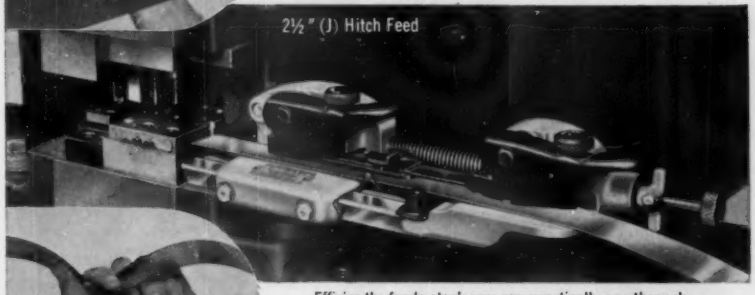
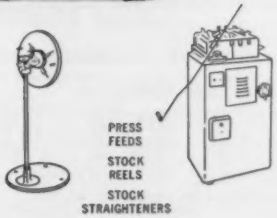
Dependably feeds strip up to 3/16" thick and 2 lbs. per linear foot.



2½" (J) Hitch Feed

Efficiently feeds stock you can practically see through.



PRESS FEEDS
STOCK REELS
STOCK STRAIGHTENERS

The Dickerman 2½" Hitch Feed®, one of the bantams of the line, feeds stock as fine as 003". in thickness, in widths up to 2½".

The Dickerman 12" Rol-Di-Feed, largest in the line, feeds stock up to 3/16" thick and in any width up to 2 lbs. per linear foot.

There are 15 "standard" feeds in the complete, versatile Dickerman line.

They all feed as fast as it is wise to run the tooling . . . and a hundred-million pieces, without major maintenance is routine.

You can gently feed a small fraction of an inch with a "Hitch Feed" or you can accurately position big, rugged strip stock up to 12" per press stroke with the Rol-Di-Feed.

Versatile, Dependable Production Savings are the reasons for specifying Dickerman Feeds. Prove it to yourself.

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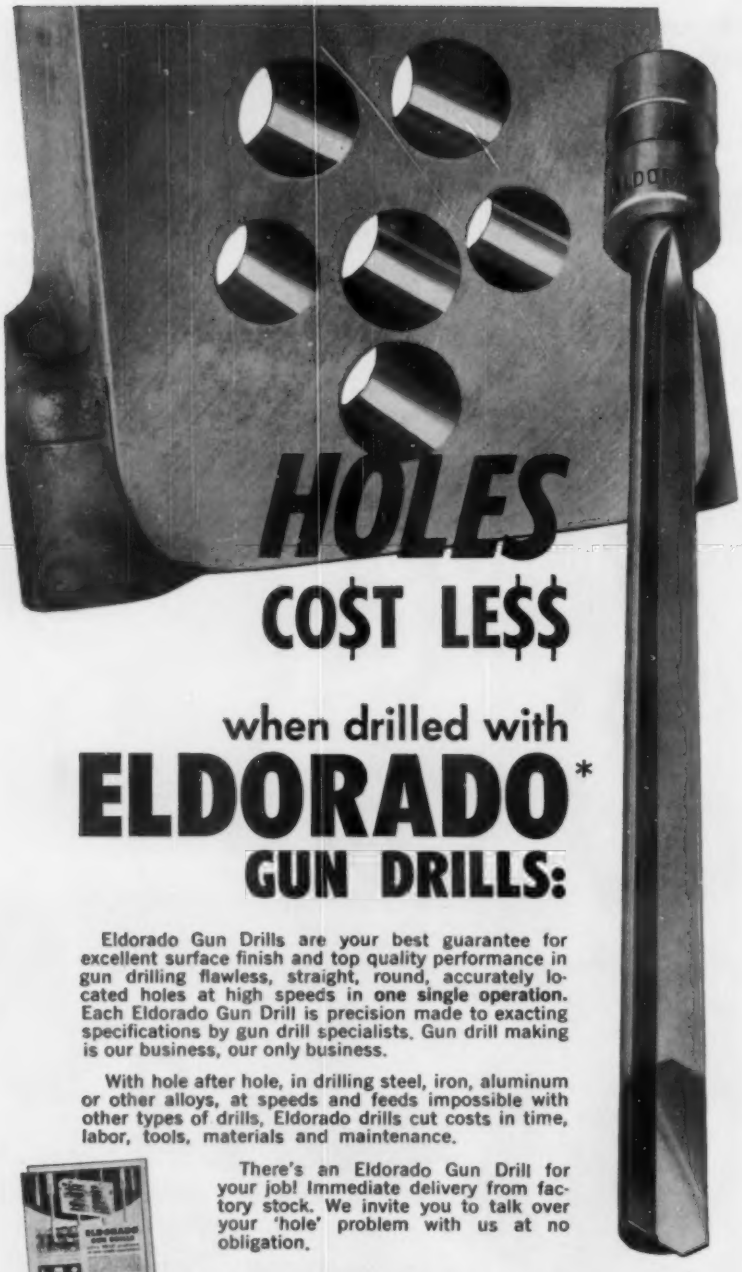

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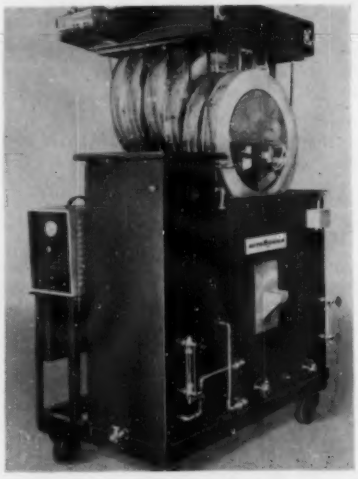
the dial are quickly adjusted to the desired plus or minus tolerance. Comparator heads with built-in electric limit contacts adapt the micrometer for mass inspection.

Mahr Gage Co., Inc., 274 Lafayette St., New York 12, N. Y. **Circle 420**

Ultrasonic Cleaning Machine Is Automated

Automation, chemical cleaning and ultrasonics are combined in the Auto-Sonex cleaning machine. Five variations of the machine range from a machine for handling small parts that



can tolerate tumbling to machines for handling either large or small parts that cannot be tumbled. Dirty, oily parts are received from the production machine at its input and clean, dry parts are delivered at its output.

Engineering Sales Offices, AutoSonics, Inc., 4217 Chestnut St., Philadelphia, Pa. **Circle 421**

Elevated Temperature Protection

Metal used at temperatures ranging from −65 through 2000 F can be protected with a coating—Cermet N16—and a related coating process. Both the coating and the process were developed by North American Aviation, Inc., and franchised for application and distribution by Seaporcel Metals, Inc.

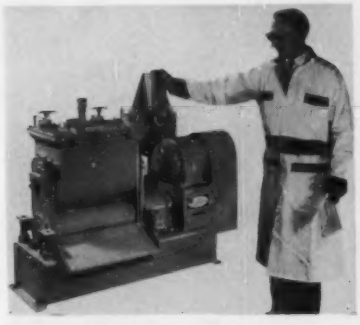
Providing comparatively inexpensive protection, the coating is adaptable to such metals as low-carbon steel, tool steel, cast steel, enameling iron, cast iron, copper, stainless steels and the

exotics. Formulation can be adjusted to obtain properties of nigh or low emissivity. Having the desirable characteristics of a ceramic coating, it upgrades various metals to stainless steel levels. Other uses of the coating include protection of burner parts for stoves, potentiometer parts, combustion items subject to vanadium pentoxide attacks and high-temperature retorts.

Seaporcel Metals, Inc., Borden Ave. and Dutchkills, Long Island City, N. Y. **Circle 422**

Vibrating Finisher Gives Fast Rinsing

This 1-cu-ft vibrator finishing machine can be tilted for rinsing while still vibrating. A manifold system of spraying the water throughout the work is provided by a rinse cover and a punch plate screen that fits the top of the bowl. This is used to separate fine or fractured chips from the rest of the media and can also be used to separate parts from the media. The HD-1016 vibrator is 10 x 16 x 13 inches with



½-inch-thick rubber lining throughout. It contains a variable amplitude shaft, adjustable from zero to ¼-inch amplitude. The frequency is variable within a range of 700 to 2100 cpm. The vibrator is driven by a 2-hp, 1800-rpm, 220/440 or 500-volt, 3-phase, 60-cycle motor and controlled by a three-station pushbutton switch.

Lord Chemical Corp., 2068 S. Queen St., York, Pa. **Circle 423**

Air Regulator Is Pilot Controlled

Remote regulation of inaccessible air lines is made possible by the Crown pilot controlled regulator. A column of controlled pressure air which applies a constant force on the diaphragm and is governed by a pilot regulator operat-

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(Continued on page 129)

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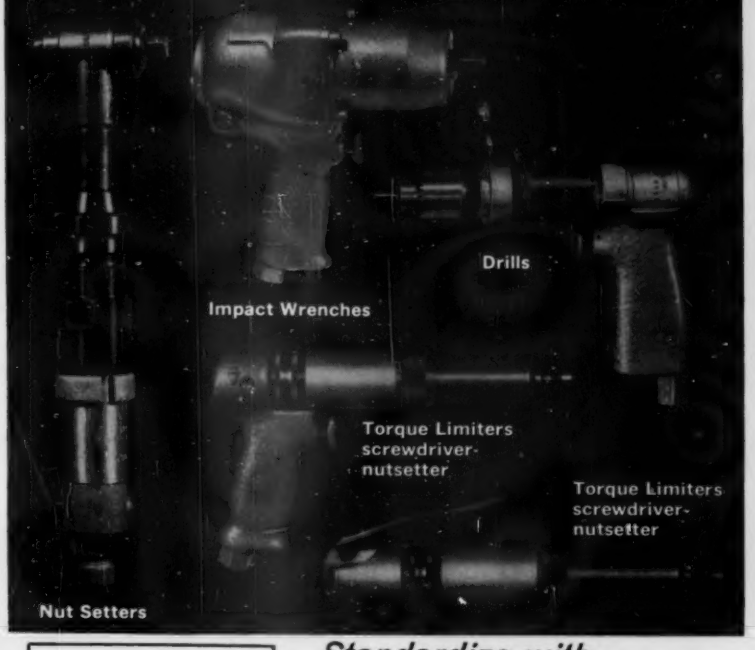

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ing at practically "no flow" replaces the adjusting screw and control spring. Any size regulator having the desired pressure range can be used as the pilot regulator. The device has a poppet type valve which opens to full pipe capacity for bleeding off excessive build-up of secondary air. Possible uses include controlling air flows through large pipe; providing two or more different pressures to a single tool or cylinder; controlling multiple or ganged air tools; and maintaining stable pressure in downstream pressure sensing systems.

Hannifin Co., 501 S. Wolf Rd., Des Plaines, Ill. **Circle 424**

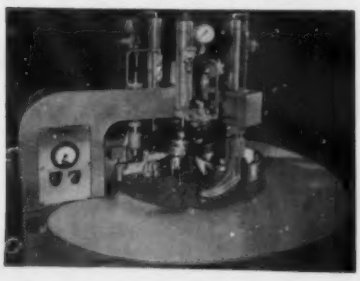
Micrometer Checks Small Diameters

This micrometer—the Mini-Mike—permits direct measurements of internal groove and land widths in bores as small as ¼ inch in diameter. With it, workpieces can be checked without removing from the machine. The instrument was developed specifically for use in the production of miniaturized hydraulic and fuel system components.

Navan Products, Inc., 900 N. Sepulveda, El Segundo, Calif. **Circle 425**

Lapping Machine Gives 2-3 Microinch Finishes

One feature of the redesigned 24-inch Lapmaster is a wrap-around adjustable worktable for rapid loading and unloading of parts from almost all positions. The machine will lap parts of most shapes, forms and materials on a production basis within tolerances of one light band or less and uniform finishes of 2 to 3 microinches. It has



Victor E. Clarke, Vice-President and Chief Engineer at Gables Engineering, Inc., holds tiny Bristol Multiple-Spline set screw, one of those used in 22 locations in tape reproducer (right) —including six in the vital, synchronous-motor-driven capstan assembly.

Bristol's Multiple-Spline socket screws help make music on the jet airlines

If you've traveled by jet recently, chances are that tape-recorded soft music and special announcements greeted you as you boarded the plane.

Chances are good, too, that they were played on a Model G-825 Tape Reproducer, manufactured by Gables Engineering, Inc., Coral Gables, Florida and supplied to the fleets of 20 leading U.S. and foreign air carriers.

Bristol Multiple-Spline socket screws, selected for their reliable holding power and easy assembly, are used in 22 locations in the G-825. "... Our uncompromising standards of quality," says Gables Vice-President and Chief Engineer Victor E. Clarke, "do not permit even the slightest risk of fastenings working loose as a result of stress or vibration in flight. Along with reliability, the Bristol screws provide simplicity of installation which contributes substantially to fast assembly ..."

These remarks are typical of the good word received from users of Bristol-originated Multiple-Spline socket screws. A few others: Can be wrenched up tighter ... holds better under shock and vibration ... socket doesn't round out ... can be loosened and tightened more times.

Bristol socket screws, with industry standard hex as well as Multiple-Spline sockets, come in a complete line from No. 0 ASA gauge to 1½". Set and cap screw types, including flat-head and button-head types, are available. Order them from your authorized Bristol Socket Screw Distributor. He carries a large selection in stock for immediate delivery and can help you select the *right* screw for your application.

ACCO

THE BRISTOL COMPANY Socket Screw Division Waterbury 20, Conn.
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an abrasive distribution system which maintains the correct mixture of compound-to-vehicle from initial filling to the last drop. It also has pneumatic lifts to speed up loading and unloading of small and medium-sized parts; a sensing head which detects and registers lap plate flatness; and a single handwheel for adjusting all conditioning rings to compensate for normal wear patterns in the lapping plate.

Crane Packing Co., 6400 Oakton St., Morton Grove, Ill. **Circle 426**

Floating Gearmotor Resists Shock

Leakproof construction is one feature of the Verti-Seal—a floating gearmotor for runout table and conveyor applications. A seal keeps the lubricating oil in the gear casing from leaking into the windings of the integral motor mounted below the gear unit. The gearmotor has single reduction worm gearing with a hollow low-speed shaft fitting over and keyed to the driven shaft. A bracket, either on the gear case or on the motor, is used to connect a spring-loaded torque arm to the table to oppose the reaction torque.

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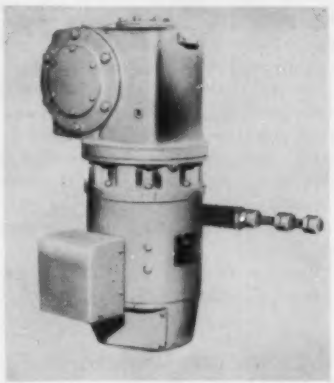


Because this allows the gearmotor to float on the driven shaft, roll-neck eccentricity is minimized and shock caused by intermittent loading is reduced. The motors are rated from 1 to 15 hp.

Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa. **Circle 427**

V-Bushing Liners Are Self-Centering

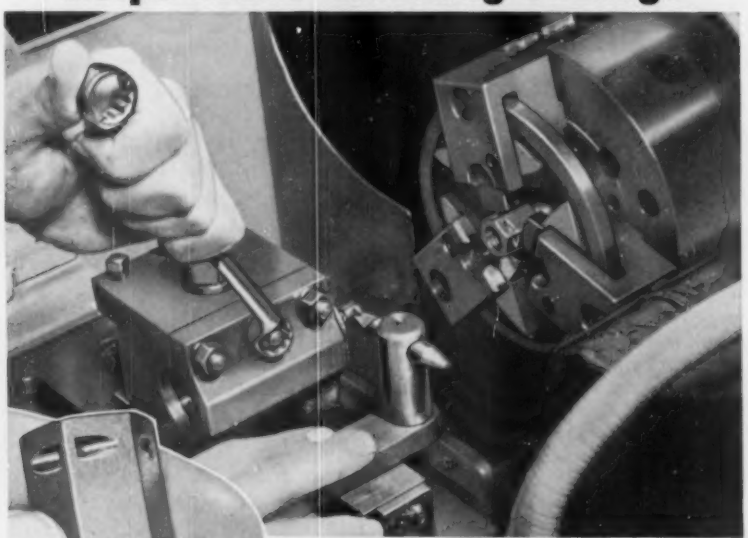
These self-centering V-bushing liners can be used with any type cylindrical, square or hex stock drilling fixture. They groove themselves on the center of the stock, permitting center drilling even near the ends of bars. They are produced in two sets of three bushings, one set with ¾-inch OD and the other with varying OD's. Both sets fit slip bushings with OD's of 5/16, 5/16 and ½ inch in a range from No. 80 to 11/32 inch in ASA or Acme standard sizes.

Acme Industrial Co., 200 N. Laflin St., Chicago 7, Ill. **Circle 428**

Miniature Power Tool Has Many Uses

Weighing less than 9 lb, the Series GG bench type flexible shaft machine can be used on materials from metals to glass as a production, toolroom or maintenance tool. It can be used for grinding, drilling, polishing, deburring and marking. Interchangeable pencil-slim and miniature angle type handpieces with shanks from 1/32 to ¼ inch permit using the tool on intricate and delicate jobs in difficult places. The unit has a 1/10-hp motor with two separate speed ranges. A gear box gives high

Buck chuck on Gisholt CRI-DAN helps make amazing savings



Photos — Acme Industrial Co., Chicago

Smart production 467% faster!

The problem: a 20 NF Class 3 thread up to shoulder in bore on hex end of 440C stainless spool valve. Tapping was slow, breakage excessive . . . hardening shrunk and distorted threads . . . rejects as high as 20%.

The solution: A CRI-DAN lathe with a Buck compensating chuck, with internal pilot bushing, to center and grip work instantly for automatic taper threading with .4675" go —.4701" no-go precision. Result: 5.03 *minutes saved per part . . . no rejects.*

In your shop, too, you'll make money *every* time you chuck with Buck.

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BUCK TOOL COMPANY

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torque at low speeds. Speeds to 12,000 rpm are possible on direct drive. The unit has a carbon-pile, continuously variable foot rheostat. It plugs into any 110-volt a-c or d-c outlet.

Foredom Electric Co., Inc., Bethel, Conn. **Circle 429**

Feeder Orients, Positions Parts

This vibratory parts feeder provides automatic, oriented position, single-line feeding of parts to various machines. At a maximum speed of 3600 vibrations per min, it handles parts up to ¾ inch

in length in 11-inch bowls, ⅞ inch in 12-inch bowls and 1¾ inch in 15-inch bowls. The unit is electromagnetically powered. It has a selective variable control for regulation of the flow rate.

Elk Engineering Works, St. Marys, Pa. **Circle 430**

Guide Line Light for Small Areas

Clear, sharp shadow lines in a pattern 8 to 16 inches wide and 4 to 8 ft long for cutting, marking or assembly operations are cast by the Model Q-5 guide line light. Half the size of the next smallest model, this light is suited for use in small areas and plants with

Impossible Milling Problem Routine with B&S Engineered Cutters!

B&S CUTTER PERFORMANCE

Original attempts to produce the piece by grinding from solid and by other methods were unsatisfactory. B&S Cutter produced pieces for a fraction of the cost of grinding. Part quality and lead accuracy exceeded requirements.

EXTERNAL THREAD
PART: Locking shaft for hydraulic gate
MATERIAL: No. 135 Nitralloy heat treated to 295 BHN
MACHINING TIME: 45 minutes
CUTTER: B&S, 4P Acme Thread Milling Cutter
SPEED: Part 4/5 RPM, Cutter 96 RPM.
LENGTH OF CUT: 11 11/16"
PRODUCTION: 4 Pieces—3 hours of close tolerance, uninterrupted cutting per sharpening

B&S CUTTER PERFORMANCE

Previously, this internal thread was tapped with unsatisfactory results. B&S Cutter lowered time and cost of production and maintained a degree of part quality, uniformity and lead accuracy considered impossible.

INTERNAL THREAD
PART: Ram shaft for hydraulic gate
MATERIAL: AISI 410 heat treated to 210-250 BHN
MACHINING TIME: 45 minutes
CUTTER: B&S 6P Acme Thread Milling Cutter
SPEED: Part ½ RPM, Cutter 200 RPM
LENGTH OF CUT: 3 15/64"
PRODUCTION: 3 Pieces—2¼ hours of close tolerance, uninterrupted cutting per sharpening

NOTE:—

In addition to the production benefits engineered into every Brown & Sharpe Milling Cutter—Cutter Service Shops in strategic locations and cutter engineering in your plant are two other EXTRAS to expect when you specify B&S.

SEND FOR CATALOG

For that EXTRA Edge in Production!

Brown & Sharpe

Cutting Tool Division
Brown & Sharpe Mfg. Co.
Providence 1, Rhode Island

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Complete Line
AMERICAN
TWIST DRILL
CATALOG

Brown & Sharpe
CUTTING
TOOLS

98 Pages

HIGH SPEED STEEL TWIST DRILLS
CARBIDE TIPPED TWIST DRILLS
SOLID CARBIDE TWIST DRILLS
DRILLS FOR HARD STEEL
SPECIAL TWIST DRILLS
ENGINEERING DATA

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Write:
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Brown & Sharpe Mfg. Co.
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DETROIT 28, MICHIGAN

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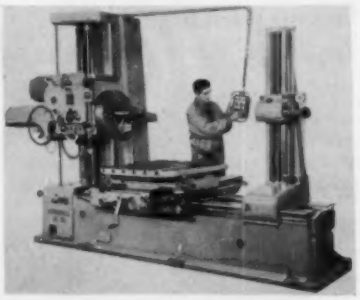
low ceilings. It has a 500-watt lamp less than 3/8 inch in diameter which will burn 2000 hr without forming carbon deposits or otherwise losing efficiency. A special reflector increases the lumen output.

Carter Products Co., Inc., Helmer Bldg., Grand Rapids 2, Mich. **Circle 431**

Machine Table Floats on Air

Model A176—a 3-inch bar Supermill horizontal boring, milling, drilling and turning machine—has an air flow suspension system that eliminates metal-to-metal contact in the table movement. Both the longitudinal and cross travel

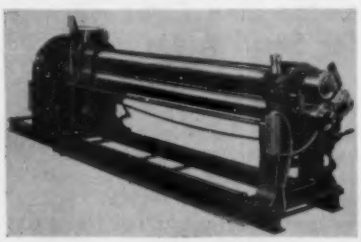


of the saddle and table are supported by a film of air supplied by a built-in air-oil compressor. The volume of air required is minute and the pressure is extremely low, measured in a fraction of 0.0001 inch.

S & S Machinery Co., 140 53rd St., Brooklyn 32, N. Y. **Circle 432**

Machine Doubles as Sheet and Angle Bender

Both a sheet bending roll and an angle bending roll are combined in this machine. It is an initial type sheet bending roll in capacities from 20 gage to 7/16 inch in widths to 122 inches and an angle bending roll that will take angles from 1 x 1 x 1/4 to 2 1/2 x 2 1/2 x 1/4 inches. The rolls of the initial type bending roll have extended journals

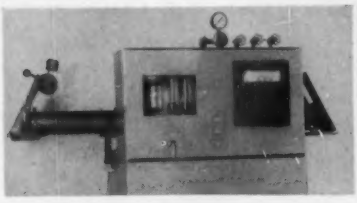


with adjustable guide rollers and interchangeable roll heads so that, in addition to angles, tees and channels, and flat and round bars can be shaped.

Hendley & Whittemore Co., 100 Blackhawk Blvd., South Beloit, Ill. **Circle 433**

Atmosphere Furnace Speeds Heating, Cooling

In place of a wire-wound ceramic muffle, this controlled atmosphere furnace uses a metal thermal tube as the heating element. The tube acts as a resistive load across the secondary coil of a transformer. This design promotes both rapid heating and quick cooling. Temperatures of 1200 C can be reached in less than 10 min and cooling to 80 C requires the same length of time. Sin-



gle or mixed gases or air can be selected for the atmosphere which, in turn, can be either dry or humidified. Models are from 2⅞ to 5¾ inch diam in capacity with operation from 220 or 440-volt single-phase curent.

Stewart Engineering Corp., Santa Cruz, Calif. **Circle 434**

Expanding Punch Gives Center Accuracy

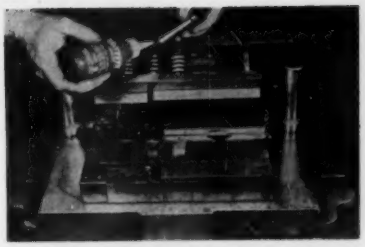
Securing true center accuracy when using a toolmaker's transfer punch is possible by using this Tru-Center expanding transfer punch. A set of three punches has a size diameter range of ¼ to 1⅛ inch with accuracy to 0.001 inch. A punch is inserted in the drilled hole; the punch body is expanded by turning the knurled head; and the

mark is secured by a hammer stroke on the center pin. The punch is removed by reversing the knurled head and retracting the expanded body. This punch is especially advantageous when working with thin material because its bottom is flush. The center pin—retained in the body of the punch in a friction sleeve—may be pulled out for sharpening. The pin is long enough to stand many resharpenings.

Kelly Tool & Mfg. Co., 3408 Monterey, Los Angeles, Calif. **Circle 435**

Plastic Sealant Locks Screws in Place

Cap and shoulder screws on press tools are locked in place and kept from loosening under impact and vibration when Loctite—a thin liquid plastic sealant which hardens when confined between closely fitting metal parts—is applied. First, the parts are cleaned and allowed to dry. Then, just enough sealant is applied to wet either the male or female threads. The parts are assembled in the usual manner and disassembled with ordinary tools. Ad-



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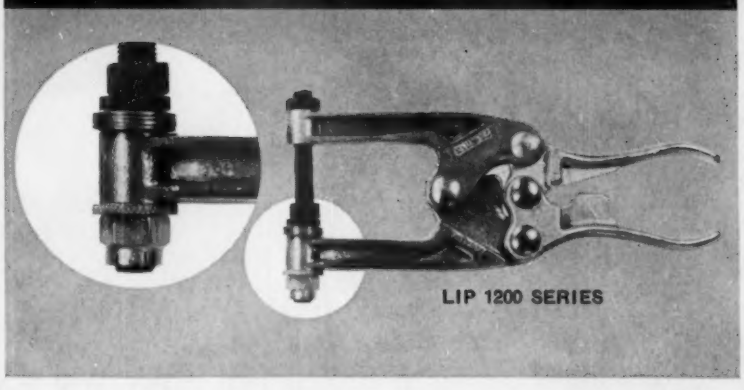
(Continued on page 136)

NEW *KNU-VISE* LOAD INDICATING PLIERS GUARANTEE CLAMPING FORCE



These pliers are for applications where it is essential, and often critically so, that a certain clamping force be applied time after time—*regardless of the thickness of the work.*

In use, the adjusting spindle is set for the desired clamping force by trial clamping. When the proper force is obtained, the self-locking nut on the anvil is then adjusted so that the LOAD INDICATING WASHER moves "just smoothly" with the plier clamped on the work. Thus, once a certain clamping force has been established it can be readily duplicated on any other work thickness simply by adjusting the spindle so that the LOAD INDICATING WASHER again moves "just smoothly" after clamping.

Write for complete information on this time-saving model.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS **LAPEER MANUFACTURING CO.**

3053 DAVISON ROAD
LAPEER, MICHIGAN

WESTERN DIV.: PECK and LEWIS CORPORATION
4436 Long Beach Ave., Los Angeles 58, Calif., ADams 3-7146
CANADIAN DIV.: HIGGINSON EQUIP. SALES LTD.
1131 Pettit Road, Burlington, Ontario

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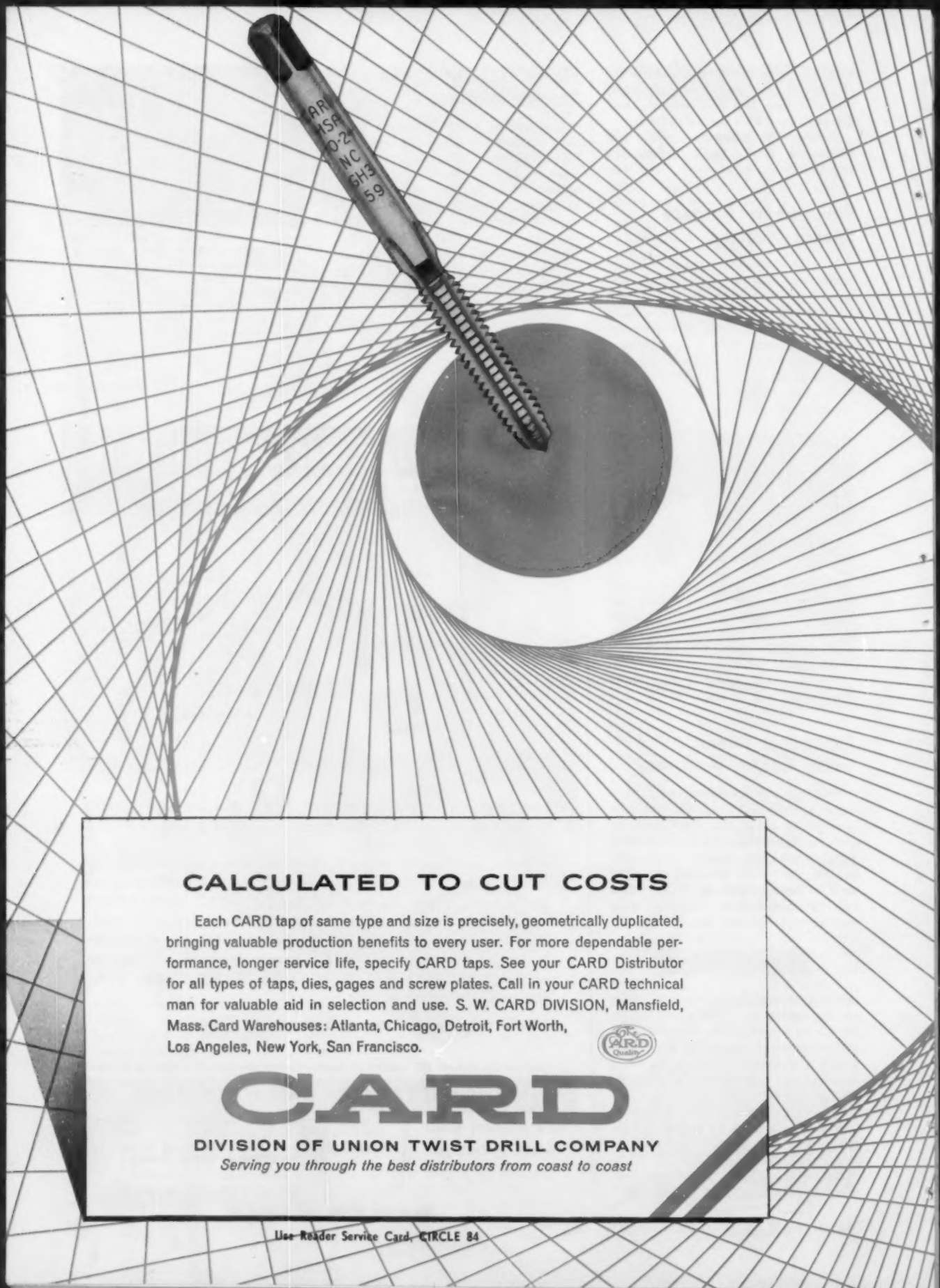

CALCULATED TO CUT COSTS

Each CARD tap of same type and size is precisely, geometrically duplicated, bringing valuable production benefits to every user. For more dependable performance, longer service life, specify CARD taps. See your CARD Distributor for all types of taps, dies, gages and screw plates. Call in your CARD technical man for valuable aid in selection and use. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

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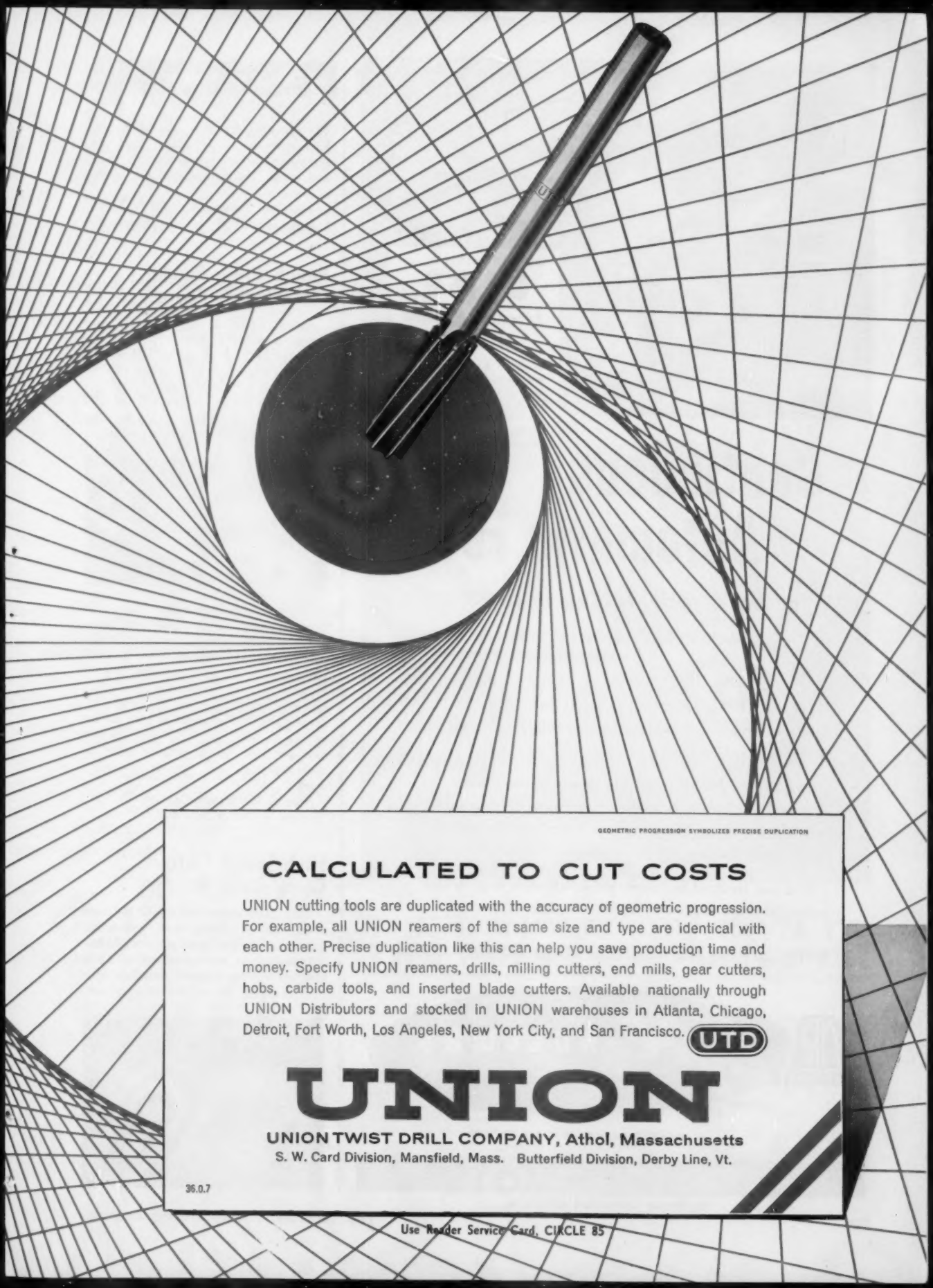

GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

UNION cutting tools are duplicated with the accuracy of geometric progression. For example, all UNION reamers of the same size and type are identical with each other. Precise duplication like this can help you save production time and money. Specify UNION reamers, drills, milling cutters, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco. UTD

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S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.

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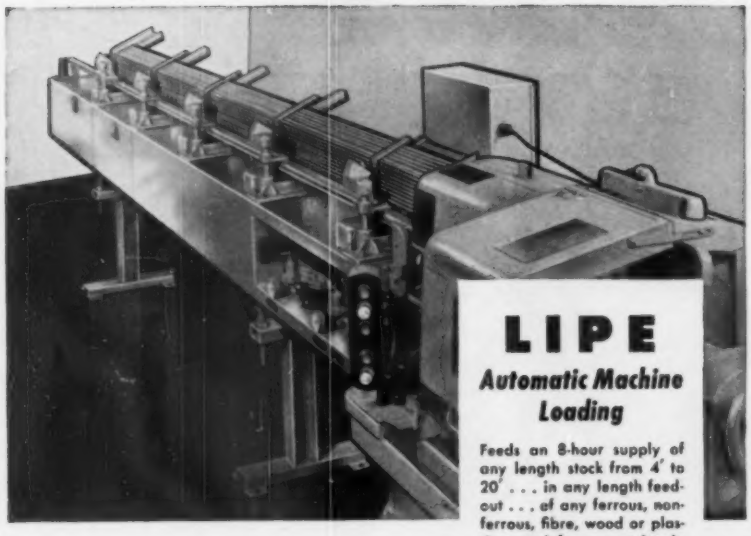


Continuous Automatic Feed

of bars, rods, tubing in practically every shape used!

LIPE AML Bar Feeds will give you faster, finer production with less scrap and refinishing and a more efficient use of manpower.

They are applicable to a wide variety of machines, including single-spindle automatic screw machines, turret lathes, centerless grinders, abrasive-wheel cut-offs, punch presses, cold headers, die machines and others.

Sold and serviced by franchised distributors in principal industrial areas. Write or wire for complete information.

STOP CUTTING AIR AND YOU START CUTTING COSTS

LIPE-ROLLWAY CORPORATION SYRACUSE 1, N.Y.

PIONEERS IN PNEUMATIC BAR-FEEDING

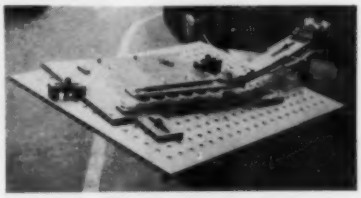
Use Reader Service Card, CIRCLE 86

ditional uses for this sealant are on hold-down bolts, adjusting nuts, set-screws and breech block die clamp nuts and studs. No softening of the screws is required.

American Sealants Co., 705 N. Mountain Rd., Hartford 11, Conn. **Circle 436**

Punch Press Feeder Has Electric Drive

Single parts, of any material and shape measuring from 3/16 inch in diameter to 20 x 20 inches and weighing from a fraction of an ounce to 5 lb, can be fed to a punch press with this electrically driven feeder. It can be used in either short runs with a locating plate or in long runs with a magazine.



Or, it can use a rotary dial. Parts are carried to the die by vacuum cups, magnetic or mechanical pick-ups at a steplessly variable rate of zero to 3600 parts per hour. The machine has an electric eye which detects parts not ejected from the die and then stops the press. Transfer of parts is with an accuracy of 0.001 inch. The machine can also be used for operations such as spot welding and various assembly work.

Special Machinery Co., 199 Bay St., Toronto 1, Ont. **Circle 437**

High-Speed Cutter Gives Good Finishes

This 2100 series cut-machining unit is capable of cutting steel, aluminum, brass, copper and most plastics. It has a 16-inch-diam saw wheel, either abrasive for cutting ferrous materials or a carbide-tipped wheel for cutting non-

ferrous materials. Powered by a 5-hp motor, the machine cuts an American standard 8-inch I-beam weighing 18.4 lb per ft in less than 18 sec; a 20-inch I-beam weighing 65.4 lb per ft is cut in less than 65 sec. A 3 x 24-inch plate can be cut in 4 min. Surface finishes of less than 100 microinches, rms, are obtainable.

Wallace Supplies Mfg. Co., 1300 Diversey Pkwy., Chicago 14, Ill. **Circle 438**

Tapping Unit Good for Multistation Machines

Overall dimensions of the TU 1400 tapping unit are 32 x $10^{15}/_{16}$ x $22^{1}/_{2}$ inches. The unit has a 6-inch spindle travel and can be used in any position, making it suitable for multiple station

arrangements on fixed or indexing tables. Electrical relays allow automatic or manual cycling, and each unit is capable of 30 reversals per min. Motors to 10 hp are supplied with the unit.

Johnson Drill Head Co., Rockford, Ill. **Circle 439**

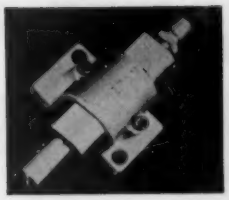
Aftercooler Ups Pneumatic Efficiency

Compressed air systems with capacities between 50 and 120 cfm can use the A4VC aftercooler. It is available in lengths from $40^{3}/_{8}$ to $95^{1}/_{4}$ inches and the cooling chamber has a diameter of $4^{1}/_{2}$ inches. The valve-regulated cooling water flows through a noncorrosive copper coil attached to the flanged head with flared connections and supported throughout its length by spaced baffle plates. These plates direct the flow of air for maximum contact with the coil. Separated moisture descends by gravity to the ball float trap at the base and is ejected automatically without loss of air. The unit will cool air to within 85 percent of the cooling water temperature.

Jas. A. Murphy & Co., Inc., 1421 E. High St., Hamilton, Ohio. **Circle 440**

Midget Tool Clamps Small Parts

With air-line pressure of 100 lb per sq in., the Midget PowRlock—a tool for clamping small components such as electric and electronic parts, control mechanisms and aircraft and missile parts—will develop piston thrust from 1050 to 1900 lb. The complete line of



these tools includes two hydraulic heads and three holders. One head, No. 2800, has a maximum stroke of ½ inch and maximum oil displacement of 0.69 cu in. The maximum number of heads per booster is four. The other, No. 2100,

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The Pangborn Vibratory Finishing Machine

THE LONGER YOU OWN IT, THE MORE USEFUL IT IS!

"Every day we find new pieces it can finish," comes the word from the large, Midwestern die-casting firm shown above. And no wonder!

This machine makes itself useful in many ways: cleaning, descaling, radiusing, fine-finishing, burnishing or coloring. It can do all this with metals, alloys, many types of plastic and ceramic parts . . . and at speeds up to 100 times faster than conventional methods. It cleans the intricate or shielded surfaces you can't reach with barrel finishing or other means.

Available in many sizes, the Pangborn Vibratory Finishing Machine is the most compact unit in its field. Its standard equipment includes variable speeds and an exclusive air-cushioned suspension which assures automatic leveling and amplitude control. Auxiliary equipment, media and compounds available for every need.

Send parts with exact finish specifications or finished specimen, for sample processing in our laboratory to: Mr. William E. Brandt, PANGBORN CORPORATION, 4700 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control, Blast Cleaning and Vibratory Finishing Equipment—Rotoblast® Steel Shot and Grit.*™

Pangborn
OF HAGERSTOWN

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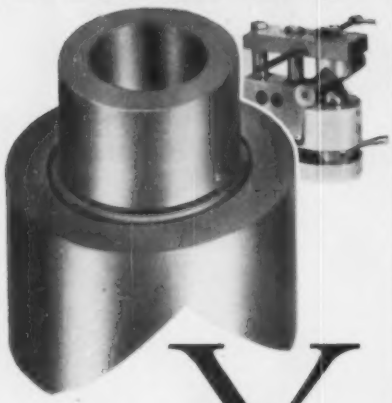
NEW



V

BUSHING LINERS*

from ACME INDUSTRIAL

To self center cylindrical, square or hex stock for drilling

V for victory over a previously ticklish drilling job . . . new hardened ground Acme Industrial V bushing liners clamp over cylindrical (round bars, tubing, etc.), square or hex stocks . . . instantly, automatically locate dead center. Layout, jig boring eliminated . . . just center punch, drill and ream hole! Acting as a liner for removable bushings, Acme's "V" assures precision centered drilling always.

Available in 2 sets of 3 V bushing liners to accommodate slip bushings with O.D.'s of 3/16", 5/16" and 1/2" in a range from No. 80 drill to 11/32" in A.S.A. or Acme standard sizes. Acme V bushing liners . . . a must for every tool box.

* patent applied for

ACME INDUSTRIAL COMPANY
210 North Laflin, Chicago 7, Ill.

☐ Send me complete information on new V bushing liners

☐ Send me the complete Acme Industrial bushings catalog

*Name*_____
*Firm*_____
*Address*_____
*City*_____ *Zone*____ *State*_____

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has a stroke of ½ inch and oil displacement of 0.345 cu in. The number of heads that can be used per booster is eight. One holder is parallel; the second, 45 deg; and, the third, 90 deg.

Wilton Tool Mfg. Co., Inc., 9525 Irving Park Rd., Schiller Park, Ill. **Circle 441**

Unit Checks Trueness to 0.0001 Inch

By using this Roto-Grind on a jig grinder or surface grinder, trueness of rings, castings, parts, missile parts, instrument parts, etc., can be checked to less than 0.00001 inch in runout and to less than 0.00002 inch in concentricity. Its variable speed motor operates

on 110-volt, 60-cycle with forward-reverse switch. It can be set up in either a vertical or horizontal position. The machine has a slip clutch, which prevents jamming or breaking of gears and has equally spaced indexing of 2, 3, 4, 6, 8, 12 or 24 combinations.

M & M Tool & Mfg. Co., 1124 E. Third St., Dayton 2, Ohio. **Circle 442**

Machine Tool Motors Have Rapid Reverse

These rapid reversing motors are available in various horsepower and phase ratings; in open drip-proof, totally enclosed fan-cooled or nonventilating enclosures; and in blower-cooled constructions. They are intended for high production machine tool applications offering up to 125 idle reversals per minute in the smaller sizes with open type construction.

Stators of the motors have slot shaped for maximum copper in windings. Rotors in the smaller sizes are cast aluminum with special slot design and low-inertia construction, while larger sizes employ high-resistance bar rotor construction with special bar and end ring alloys for optimum performance.

Louis Allis Co., 427 E. Stewart St. Milwaukee, Wis. **Circle 443**

These important parts are cold-formed from coiled wire, start to finish in compact, efficient National Cold Headers.

The top three are formed with no scrap loss, ready to use! All six achieve remarkable savings over past methods.

If you make odd-shaped parts, may we help you evaluate them for cold-forming from wire? Better yet, come to Tiffin, witness our demonstrations and let's discuss your work.

National ½" Five-Station Progressive Cold Header

NATIONAL MACHINERY CO.
TIFFIN, OHIO, U.S.A.
HARTFORD DETROIT CHICAGO

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Parts Feeder Orients, Counts

As many as 3000 parts per minute can be fed, oriented and counted by the 30-inch Disc-O-Matic parts feeder. It can be adapted for continuous feeding of parts or for mechanical releasing of one or more parts at a time. It can also be set up for electronic counting

or batching. The machine has an adjustable track for handling a wide variety of shapes and sizes and a variable speed drive which can be changed while the machine is operating.

Count-O-Matic, Inc., Div. of U.S. Engineering Co., 40-24½ 22nd St., Long Island City 1, N.Y. **Circle 444**

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Brazing Compound for Refractory Metals

Capable of withstanding environments to 1800 deg C, this high-temperature brazing compound is suitable for joining porous, refractory metals such as tungsten, molybdenum or tantalum to solid materials without infiltration of the permeable material. Other characteristics are low-vapor pressure and a low rate of diffusion. Its applications include joints in refractory materials, thermionic converters and electronic components.

Electro-Optical Systems, Inc., 125 N. Vinedo Ave., Pasadena, Calif. **Circle 445**

Collet Chuck Spans Wide Size Range

This special Model 501 collet chuck, because it can use standard 500, 400 or 100 series collets, spans the size range from ¼ to 1⅝ inches with 0.0005 inch accuracy. Each collet collapses a full 1/32 inch and special collets are available in decimal sizes from 0.218 to 1.625 inch. Two camming surfaces collapse the collet over its entire length as the nose piece is drawn in, enabling the collet to grip drills and end mills

Now priced 30% lower, advanced design Joydex end mills are economical *performers* too. Indexable, throw-away blades provide: *low* cost per edge; fast, easy indexing or blade replacement; double positive, or combination positive and negative rake angles by just changing blades. And . . . extra deep chip flutes on body really step up work capacity. Available with Weldon or Bridgeport shanks.

Send for details on complete Joydex line of end mills, face mills and half side mills.

LOVEJOY TOOL COMPANY, INC.
Springfield, Vermont, U.S.A.

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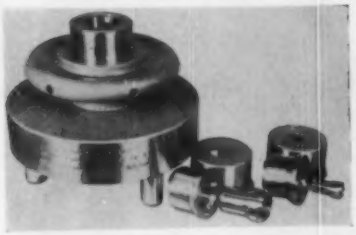
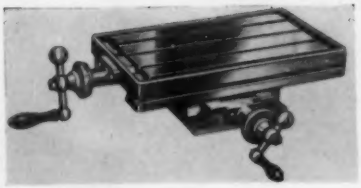


on their flutes as well as on straight shanks. Collets are self-releasing. The chuck has a hand spinner ring for rapid collet closing and opening.

Erickson Tool Co., 34350 Solon Rd., Solon, Ohio. **Circle 446**

Milling Table for Geared-Head Presses

Used on geared-head drill presses, this compound milling table is suited for operations involving end mills to ½ inch in diameter and jig boring requiring medium accuracy. Designed for exceptional torque, the table has a work surface size of 22½ x 9½ inches,



two T-slots, a perimeter coolant trough and a third T-slot in the front vertical table surface. Longitudinal feed is 14¾ inches and cross feed is 6½ inches. The ballcrank handles read in 0.001-inch increments.

Boice-Crane Co., 934 W. Central Ave., Toledo 6, Ohio. **Circle 447**

Infrared Thermometer Controls Temperature

Because it uses infrared detection, the Thermodot radiation thermometer measures and controls temperature without contact. It provides measurements from 210 to 3300 F and is compensated for ambient temperatures from 50 to 120 F. Response time is 0.3 sec. Model TD-6 can be used in assembly line production, industrial testing and quality control as well as in process control and automation systems. Typical applications include measurement and control of temperature in industrial heating, inspection and quality control in metal fabricating, and process control and nondestructive testing of rubber products, ceramics and plastic sheet.

Radiation Electronics Co., 5600 Jarvis Ave., Chicago 48, Ill. **Circle 448**

Toggle Clamps Are Air-Operated

This series air or hydraulic-operated toggle clamps is designed for use in hard-to-reach areas and for rapid sequence of assembly operation on light jobs in everything from plastics to metalworking. With over-center toggle locks that eliminate bounce or recoil, these units have holding pressures to

450 lb at 80-lb line pressure. They can be used individually, in series, sequentially or simultaneously. They are double acting with 1⅛ bore and 1⅞ stroke and provide operating pressures up to 150 psi air and 250 psi oil. Each of the three models in the series weighs 1 lb, 10 oz and provides clamping pressures to 350 lb.

Detroit Stamping Co., 330 Midland Ave., Detroit 3, Mich. **Circle 449**

Special Inserts Eliminate Cutter Grinding

Each of the five interlocking indexable insert milling cutters, makin gup a gang set, machines the jaw contour on oil tool tongs in one pass. Cutter grinding is eliminated and four sharp edges per tip that can be rapidly indexed to renew the cutting edges at the machine are provided through the use of indexable carbide insert cutting tips. Pockets in the cutter body insure tip concentricity at each indexed position. These pockets are in turn protected from damage by removable seat blocks also made of carbide.

Wetmore Tool & Engr. Co., 5320 E. Washington Blvd., Los Angeles 22, Calif. **Circle 450**

All-Purpose Welding Machine

By changing a switch or by using plug-in controls and accessories, this all-purpose combination a-c and d-c inert gas shielded arc welding machine can be used for manual, automatic, tungsten inert gas, inert gas spot or gas shielded arc consumable electrode welding. It is available in two models—AD1-2641, rated at 200 amp, and AD1-3641, rated at 300 amp. Model AD1-2641 has a welding range of 1 to 300 amp a-c or 1 to 350 amp d-c. The welding range for Model AD1-3641 is 1 to 375 amp a-c or 1 to 410 amp d-c. Both models are equipped with a hand switch for remote control, adjustable post flow timer, power factor correction and ballast resistor to stabilize the a-c inert gas welding current. Both machines operate from single-phase 230/460 a-c power.

Hobart Bros., Troy, Ohio. **Circle 451**

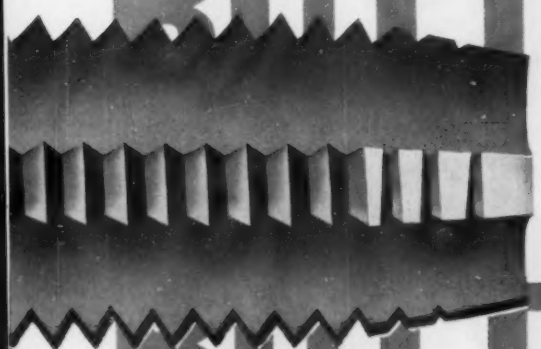
Magnetic-Based Lamp for Small Areas

This magnetic-based lamp solves the problem of rigid positioning of lamps for permanent or temporary use. Designed primarily for the machine tool field where work area lighting is often inadequate, the lamp is available in two styles—the Arealite which illuminates a wide area and the Magnaspot which provides concentrated light. The lamp is molded of high-impact plastic and engineered to provide a cool-to-the-

touch exterior. The base, measuring 2¼ x 1½ x 1 inch and weighing 10 oz, has a holding power of 60 lb. The base will not lose holding power from impact, heat, usage or storage. It is covered with tough polyvinyl chloride.

Recarr, Inc., 126 N. Clinton St., Chicago 6, Ill. **Circle 452**

BUTTERFIELD



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Trade Literature

for free booklets and catalogs—use request card, page 127

Automation, Mechanization

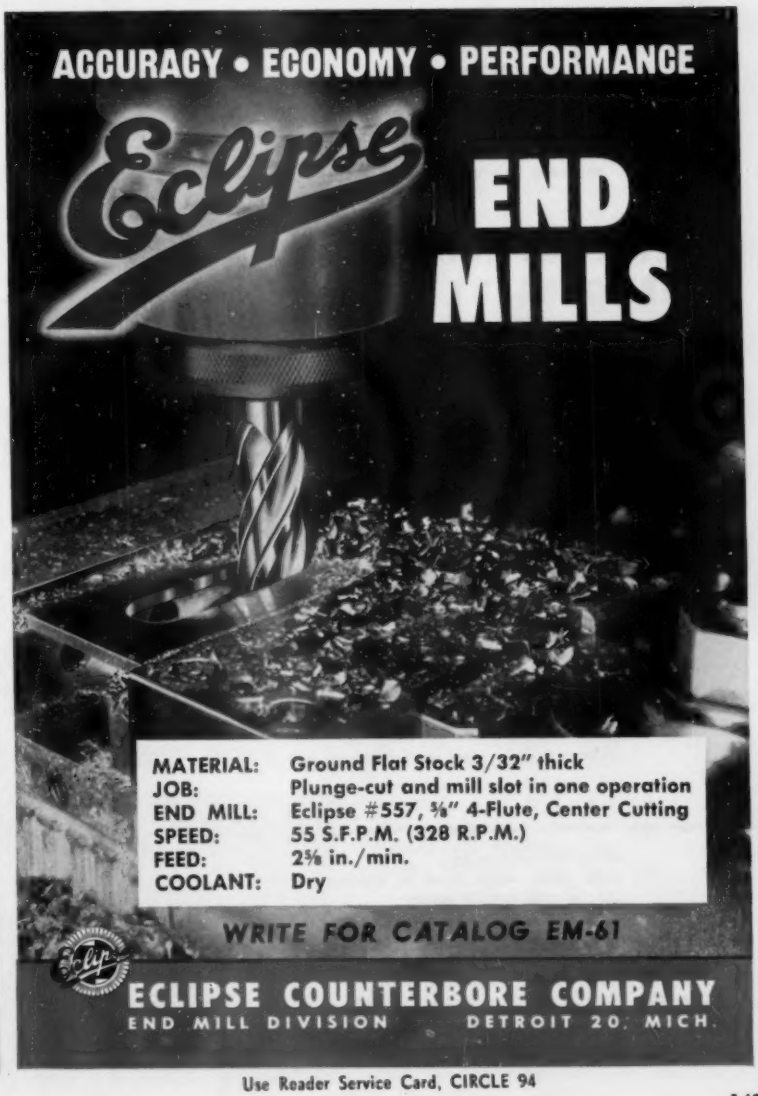
Modulated-light projectors are used in a line of photoelectric protective equipment for automatically stopping machine operation when any part of a person's body enters the danger area. These "curtain of light" devices are directly mounted on presses and other industrial machines. Clark Controller Co. **(Circle 501)** . . . A numerical contouring system, two numerical positioning systems and a coordinate measuring machine are described in a catalog. Bendix corp. **(Circle 502)** . . . A brochure covering several important automatic programming systems for the Bendix G-15 digital computer describes the general characteristics of automatic programming systems for both commercial and scientific computer applications and includes illustrations of typical problems. Bendix Computer Div. **(Circle 503)** . . . A line of automatic component handling equipment—including axial lead straightening machines, lead trimming and bending machines and circuit board inserting and assembly machines, as well as a variety of automatic devices—is designed for use by component manufacturers and volume users of capacitors, transistors, coils and other components. Design Tool Co. **(Circle 504)**

Cleaning, Painting, Plating

One page of a folder deals with the various applications of fused quartz radiant ovens. Other pages are devoted to performance data, wave lengths for proper energy distribution, and various baking and curing problems. Cleveland Process Co. **(Circle 505)** . . . An ionic electrostatic hand gun is capable of applying conventional and highly conductive type coating materials indoors and outdoors. Ionic Electrostatic Corp. **(Circle 506)** . . . A brochure describes and explains how zinc rich coating can be brushed or sprayed on iron or steel surfaces to provide galvanic protection against rust and rust creepage. Sealube Co. **(Circle 507)** . . . A strongly alkaline cleaner can be used in cleaning tanks or in steam cleaning operations. Oakite Products, Inc. **(Circle 508)**

Finishing, Grinding

A publication entitled "American Standard Specifications for Standard Shapes and Sizes of Grinding Wheels, B74.2-1960" classifies, according to twelve end use categories, the shapes and sizes of grinding wheels which are considered standard by industry. Write the Grinding Wheel Institute, 2130 Keith Bldg., Cleveland 15, Ohio . . . "Brushing Tools Engineered for Industry"—a brochure which answers questions about brushes and gives many applications of various brushes—can be obtained by writing to the Industrial Brush Div., American Brush Manufacturers Assn., 1900 Arch



Use Reader Service Card, CIRCLE 94

St., Philadelphia 3, Pa. . . . Specifications and dimensions of each of five models in a line of standard-duty blast cleaning barrels and a number of case histories are presented in a booklet. Pangborn Corp. **(Circle 509)** . . . A new vibratory machine can be used for mixing, pulverizing, deburring, descaling, cleaning and screening, and for grading stones, or for surface refinement of any metal parts. Stevenson Co. **(Circle 510)** . . . A brochure sets forth the specifications and advantages of a series of abrasive belt machines capable of handling workpieces from 0.05 to 3 inches thick and 49 inches wide with infeeds to 100 ipm. Carborundum Co. **(Circle 511)** . . . *A Diamond Data* article titled "New Requirements in Grinding Wheel Evaluation" points out many of the pitfalls inherent in testing diamond grit and suggests methods by which they can be circumvented. Engelhard Hanovia, Inc. **(Circle 512)** . . . A fiber-backed abrasive disk for lighter grinding operations, where little or no dressing action is involved, has high resistance to loading and controlled breakdown of the abrasive coating. Carborundum Co. **(Circle 513)** . . . A brochure depicts several types of surface grinding wheels, segments and disks for the metalworking industry. Jowitt & Rodgers Co. **(Circle 514)** . . . Two 1-page technical bulletins describe features and operation of deburring and chamfering grinders for spur and helical gears and for bevel gears. One type of grinder is available in three sizes for gears from 1 to 24 inches OD and the other is available in three sizes for gears from 1 to 36 inches OD. Michigan Tool Co. **(Circle 515)**

Heat-Treating

Following an introduction on vacuum metallurgy, a 24-page booklet covers vacuum arc melting furnaces, induction heated furnaces and resistance heated furnaces. Consolidated Vacuum Corp. **(Circle 516)** . . . The use of crowned abrasive material on inflated finishing wheels is described in a leaflet. Nu-Matic Grinders, Inc. **(Circle 517)**

Materials

A general purpose, shallow hardening, fine grain carbon tool steel is intended primarily for trimmer and die steel applications. Heppenstall Co. **(Circle 518)** . . . Changes made in a nickel-base alloy have increased ductility to the 1100 to 1900 F range and increased tensile strength to the 1400 to 1600 F range. Haynes Stellite Co. **(Circle 519)**

Punches, Dies

"Metal Stampings in Small Lots" suggests basic designs for relief notches for right angle bends and for extruded holes for tapping. Dayton Rogers Mfg. Co. **(Circle 520)**

Turning

A redesigned bar automatic has variable forward and return turret feed controlled through an improved, simplified mechanical drive, using a separate feed motor and an automatic, air-operated disk type friction feed clutch. Cleveland Automatic Machine Co. **(Circle 521)** . . . A catalog covers a line of circular form tools and blanks for use in automatic screw machines. Somma Tool Co. **(Circle 522)**

Welding, Soldering, Brazing

Two wall charts illustrate characteristics of oxy-LP and oxy-acetylene flames for welding and cutting. Smith Welding Equipment Corp. **(Circle 523)** . . . A new high-strength low-temperature solder alloy is a preform material able to withstand loads at elevated temperatures without serious deformation. Accurate Specialties Co., Inc. **(Circle 524)**

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Men at Work

S. PAUL BURNS has joined Paramount Engineering Co. as executive vice president and member of the board of directors. Prior to joining the Madison Heights, Mich. firm, Burns served in a similar capacity at Pioneer Engineering and Manufacturing Co. In his new assignment, Burns will be responsible for the activities of the various engineering divisions as well as all sheet metal, wood shop, plastics shop, foundry, prototype and machine shop operations.

Daniel C. McCarthy has recently been elected to the post of executive vice president of Pratt & Whitney Co., Inc., West Hartford, Conn. He will be responsible for the activities of the sales, engineering, manufacturing and accounting departments. He joined the company in April 1960.

The position of vice president in charge of production, Latrobe Steel Co., Latrobe, Pa., is to be filled by WALTER T. HASWELL, JR. Haswell, who succeeds R. T. EAKIN, has been works manager for the past five years. Joining the Company in 1945, Haswell has been assistant superintendent of the cold finishing department, assistant production manager of the hot mills department and superintendent of the cold finishing department.

OSCAR L. DUNN has been named a vice president of General Electric Co., Schenectady, N. Y. He is general manager of the company's motor and generator division, with headquarters in Erie, Pa. Dunn has been associated with General Electric since his graduation from Indiana University in 1936.

WILLIAM V. WRIGHT has been appointed a vice president of Electro-Optical Systems, Inc., Pasadena, Calif. Wright will continue in his present position as manager of the company's solid state division but will also acquire responsibilities for policies concerning proprietary programs, subsidiaries and expansion activities. Prior to joining EOS, Wright was program director of semiconductor materials for Pacific Semiconductors, Inc.

J. R. MILLER has been appointed group vice president in charge of manufacturing, engineering and industrial relations for the Dana Corp. In the past, he has served as general manager of the Link Belt Ordnance Co., Chicago, and as vice president of the Beaver Tool and Engineering Corp., Royal Oak, Mich. Other appointments in the Dana staff are vice president of manufacturing,

Kurt H. Hampel (left) has been named general manager of Tann Bearing Co., Detroit, Mich. Before joining Tann, he was manager of the pulley division of Active Tool Co. Hampel was professional engineer in Germany. Wallace W. Straton (right) was named chief product engineer. He was formerly an engineering supervisor for Active Tool.

Holmes H. Whitmore has assumed the duties of president and chief executive officer of Jones & Lamson Machine Co., Springfield, Vt. Employed by the company since 1941, Whitmore is vice president and director of Le Progres, J & L, Belgium, and president of the Springfield Manufacturers Assn., Springfield, Vt.

Three executive appointments have been announced by Atlas Steels Ltd., Welland, Ont. W. A. Thomas (left), vice president of operations, has been transferred to the corporate staff. He will have functional direction of all production activities. Arthur C. Rae (center) has been assigned to the position of vice president and general manager of the North American Div. in charge of all operations and sales. Fletcher Peacock (right) has been appointed general manager of the International Div., responsible for the administration of all international operations and the sale of its products in world markets. The appointments were effective January 1.

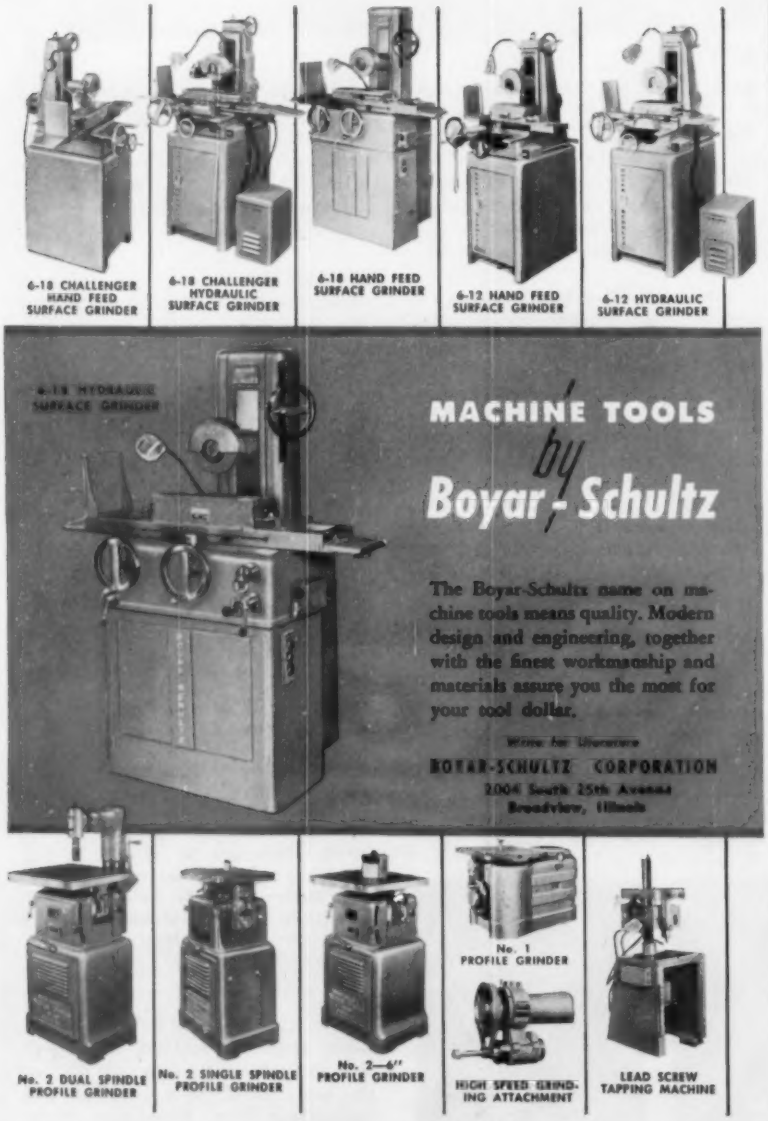
Men at Work

E. M. Douglas; director of engineering, P. J. Mazziotti; and technical director of the newly formed international division, R. R. Burkhalter.

Ralph F. Gow was elected president of Norton Co., Worcester, Mass., and Milton P. Higgins, president since 1946, stepped up to chairman of the board. Higgins succeeds George N. Jeppson, who remains on the board with the title of honorary chairman. John Jeppson becomes executive vice president succeeding Gow. Robert Cushman and Richard M. Nichols were named directors. Gow, who joined the company's research laboratory in 1925 after graduation from Massachusetts Institute of Technology, has been executive vice president since 1948.

A new slate of company officers has been announced by J. Holland & Sons, Inc., Brooklyn, N. Y. Louis Holland was named president and is now responsible, in addition to administrative duties, for the company's inventory control program and operation of its manufacturing divisions and subsidiary operations. William Holland, elected treasurer, is in charge of all financial administration as well as general management including sales and service. Arthur Holland was elected secretary and Abraham Polmar, vice president.

Harry B. Cummings has been named president and Nicholas Kay, senior vice president of Thomas Flexible Coupling Co., Warren, Pa. Other officials elected for the Koppers Co. subsidiary were John Crimmins, secretary; Edward Shuck, treasurer; William B. Sawers and Glen Werner, vice presidents; and John Tellman, George Bachtel and John Lardner, assistant secretaries and assistant treasurers.



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James Oakley, director of manufacturing, was elected vice president of manufacturing, a new position in the Clayton Mark & Co. organization. Prior to joining the Evanston, Ill. firm, Oakley was manager of manufacturing for Crane Co. and Inland Steel Products Co.

Appointment of Paul Bailly as president of Bear Creek Mining Co., Kennecott Copper Corp.'s domestic exploration subsidiary, has been announced. He will be located in Salt Lake City, Utah. Bailly joined Kennecott in 1952.

TOOL ENGINEERING in Europe

By M. Kreusberg
Consulting Engineer
Cincinnati 6, Ohio

Cutting Force Pulsations

Most cutting force dynamometers are primarily intended for measuring the average cutting force without taking its pulsation into account. A recent development in this field—a dynamometer that reacts to pulsations—is discussed by Dino Ferraresi in *Der Maschinenmarkt*, Vol. 97, Dec. 2, 1960, p. 43 ff. The title of his article is "Dynamische Schnittkraftmessungen beim Drehen." The instrument, developed by Ferraresi, measures the oscillation of the cutting force in turning operations and, at the same time, determines its static mean and amplitudes. Cutting is not affected by the new instrument, which has a natural frequency about three times as high as the expected frequencies of the pulsating cutting force. The static deflection under a load of 880 lb amounts to about 0.004 inch, which corresponds to a load of 2200 lb for a deflection of 0.001 inch. The resonance frequency is 6000 to 6800 cps.

Two components of cutting force can be measured simultaneously with this instrument—the main cutting force tangential to the workpiece and the cutting force in the direction of chip in a horizontal plane. Tests showed that the measured frequency of the pulsating cutting force agreed in all cases with the frequency that can be calculated from the number of serrations on the chip, the prevailing cutting speed and the chip compression factor.

Since serrations on chips cannot always be accurately measured—or even seen—it was not always possible to compare the measured frequencies with calculated frequencies. The comparison was limited to speeds between approximately 250 fpm and 400 fpm. The author concludes, however, that the instrument covers the entire range of cutting speeds, even though a comparison is not possible at all speeds.

The magnitude of the amplitude of the pulsating cutting force could also be associated with the formation of serrations. Serrations are small when the amplitude is small. They increase with the increase in amplitude at increasing cutting speed up to a certain point. Then they decrease with decreasing amplitude at a further increase in cutting speed.

Tape Standards

Eight-channel, one-inch-wide tape is used on most American numerically controlled machine tools. German engineers have been debating whether or not to adopt this American standard tape, in preference to the conventional five-channel tape used in Germany. The pros and cons of this subject are discussed by W. Simon in an article appearing in *Werkstatt und Betrieb*, Vol. 93, No. 11, 1960, p. 693-701. His article is titled: 'Gedanken zur praktichen Gestaltung zahlengesteurter Werkzeugmaschinen."

With five-channel tape, only 31 hole combinations are possible. With eight-channel tape, on the other hand, it is possible to punch 255 combinations. The amount of space available for reading commands is limited wth five-channel tape; with eight-channel tape adequate space is available.

Eight-channel tape is, of course, adaptable to American typewriters such as the Flexowriter. The European five-channel tape is adaptable to the European teletype system, making it possible to teletype numerical commands from one place to another, utilizing the commercial teletype network and equipment. The use of American equipment would add to the total cost of installing numerical control in Europe. For this reason, Simon feels that the five-channel tape should be preferred in Europe, provided that the reliability of European tape readers is improved. At present they are inferior to American models. Also, digital-analog converters are not made in Germany, which creates difficulties for German machine tool builders interested in numerical control. The standardization of five-channel tape in Europe would affect the export of American machine tools to Europe.

In the same article, Simon touches upon the various numerically controlled machine tools that were exhibited at the Hannover Exposition.

Wheel Balancing

Since grinding machines are rigidly constructed, it is rather difficult to balance grinding wheels on the machine except by disconnecting the spindle from the machine frame. In the con-

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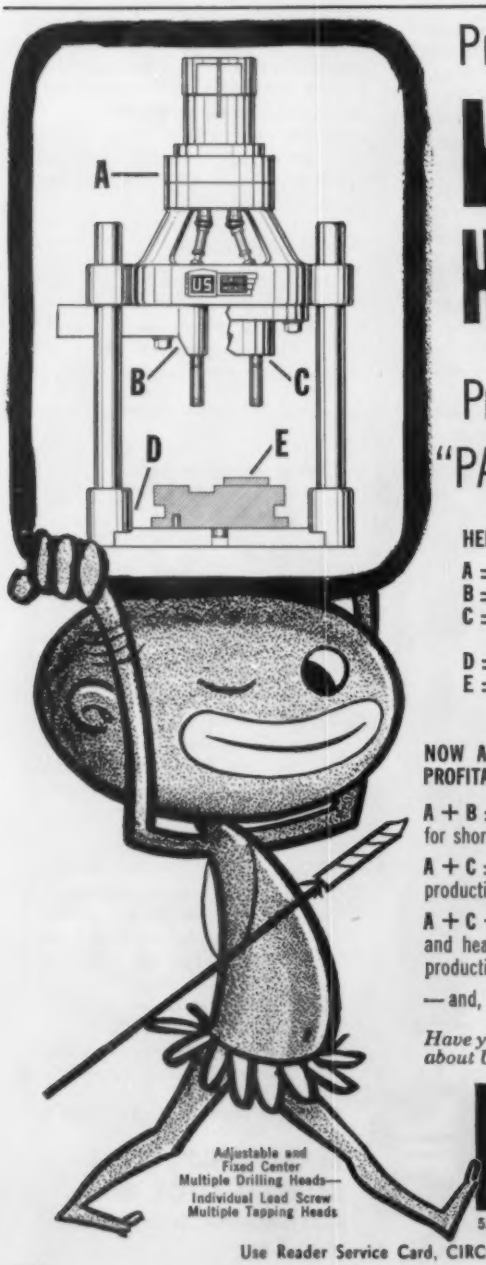
ventional balancing method, the grinding spindle rests in "soft" bearings until balance is attained and is then returned to rigid support. This method, says H. Klum, writing in *Technisches Zentralblatt fuer praktische Metallbearbeitung*, Vol. 54 11, 1960, p. 553-556, is costly. In his article "Das Auswuchten von Schleifscheiben in der Schleifmaschine," he describes a balancing method that does not require the spindle to be disconnected. The method he describes minimizes wear and tear on the spindle and also eliminates the inaccuracy that results from repeatedly changing the spindle support.

An electronic instrument is used in the new balancing method. This permits balancing the grinding wheel even when the machine is extremely rigid. Klum claims that the instrument is more sensitive than other types. The instrument has a scale that is graduated so that it is possible to read the angles at which the balancing weight must be positioned relative to the light side of the wheel. There is no need for calculation. With the usual universal balancing devices, it is possible to find the light side only, and time-consuming calculations are required to find the balancing position of the weights.



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Machining Stainless Steel

A short article in *Machines and Tooling*, Vol. 31, No. 3, p. 26, is a translation of an article by N. P. Golubov that appeared in *Stanki i Instrument*. The author gives the results of Russian investigations into the machinability of stainless steel. Compositions of the steels are not included.

The author recommends the following tool geometry: true rake, 7 deg; side cutting edge clearance angle, 10 deg; end relief angle, 10 deg; lead angle, 45 deg; end cutting edge angle, 15 deg; back rake, 0 deg; nose radius, 0.040 inch. When turning heat-resistant steel, the true rake should be reduced to 5 deg (or to 3 deg when turning scaly surfaces) according to the author.

Several equations for tool life and cutting speed are presented in the article. These are based on the (orginally American) standard of 0.040-inch wear land on the tool flank. Carbide tools were used, without coolant. Tool life was found to be inversely proportional to the fifth power of the cutting speed. (This is not very different from the carbon steel relationship.)

The author also found that the cutting force tangential to the work surface is not affected by the cutting speed until speed exceeds 164 fpm. Increasing the speed to about 500 fpm causes a 20 percent drop in the cutting force. Further increases in speed have no effect on the cutting force.

Cutting forces in the horizontal plane are also covered in the article. Recommended variations in tool geometry and correction factors for different stainless steel types are given.

Ultrasonic Machining

The magnetostrictive effect is utilized in a glass lapping machine developed by G. Pahlitzsch and D. Blank, who report on their findings in *Werkstattstechnik*, Vol. 50, No. 11, 1960, p. 592-599. The title of their article is "Fortschritte beim Stosslaeppen mit ultraschallfrequenz." In this type of machine, the toolholder expands and contracts in the longitudinal direction under the influence of a high-frequency electric field.

The tool is mounted at the lower end of an iron-nickel rod. The rod is excited at its natural frequency in order to obtain amplitudes that can be used in the machining of glass. The entire toolholder-tool system, making up a vibratory system, is pressed against the workpiece by a small force produced by a helical spring.

The authors state that several scientists have tried in the past to find the basic relationships for the ultrasonic machining of glass through experiment,

but that their results were erratic. The use of special suction systems in the authors' experimental setup reduced the scattering of results considerably. In the course of the authors' experiments, it was found that the resonance field changes with the feed rate, while the amplitude does not vary much with the load, provided that the resonance field is adjusted when the feed rate is changed. The tool oscillates under water and hence it is damped according to its cross section.

The practical consequences of these investigations can be summarized as follows: Impact lapping ("Stosslaeppen"), as the process is called by the authors, can be used for drilling holes up to 0.4 inch deep, as against the previously attainable depth of 0.004 inch. The material-removal rate is 1000 percent greater than with older methods—up to 0.12 cu in. min. (This is much slower than standard metalcutting methods. In lathe work, a metal-removal rate of 20 cu in. min is a conservative value; rates to 6000 cu in. min have been attained with ultrahigh-speed machining.) In impact lapping a feed rate of 1.4 ipm has been attained and surface finishes are comparable to conventional lapped finishes.

The authors intend to apply this new process to the machining of carbides and call attention to the fact that the tool is oscillating at a frequency of 20,000 cps, producing an acceleration 8000 times gravity. Because of this acceleration, a special device for securing the tool to the iron-nickel rod is needed.

Grinding in Russia

One of the problems that require study in the grinding of gas turbine blades is the work hardening that takes place on the ground surface. This may cause residual stresses that cause rejection of the blades. A. V. Yakimov and G. G. Kravchenko, Russian engineers, have investigated work hardening of turbine blades and report on their findings in *Stanki i Instrument*. Their article is translated into English in *Machines and Tooling*, Vol. 31, No. 3, 1960, p. 11-13.

This type of grinding is equivalent to interrupted cutting and the forces are difficult to calculate, owing to the interrupted nature of the cut. The authors measured the forces with strain gages, using a setup that is described in some detail in the article.

It was found that the impact load is three to four times greater than a comparable load without impact. The impact causes increased work hardening on the trailing edge of the blade. Work hardening can be considerably reduced by flood cooling. Dulling of the grinding wheel must be avoided because it increases the impact forces and thus increases work hardening. The authors recommend the redesign of the grinding machines used for turbine-blade grinding in Russia.

Positioning Methods

In an article reviewed last month in this column it was shown that the accuracy of positioning tables in numerically controlled machines depends greatly on the masses driven, the friction and other qualities of the driving elements. Another article dealing with this problem appears in *T. Z. fuer praktische Metallbearbeitung*, November 1960, p. 539-543. The title of the article is "Der Auslaufweg translatorisch gleitender Massen," by G. Alich.

Alich presents a thoroughly developed mathematical analysis, which has been proved out by practical tests. In the article he considers the case of leadscrew drives with d-c and a-c motors running at various spindle speeds. His diagrams include data from the over-travel of lathe carriages and milling machine tables at different feed rates, and for electrohydraulic drives. The data presented are calculated from formulas and proved out by tests.

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who's meeting and where

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Mar. 6-8. AMERICAN MANAGEMENT ASSOCIATION. Seventh annual data processing conference and exhibit. Statler-Hilton Hotel, New York, N. Y.

Mar. 8-10. INSTRUMENT SOCIETY OF AMERICA. Annual conference on instrumentation for the iron and steel industry. Roosevelt Hotel, Pittsburg, Pa.

Mar. 13-17. SOCIETY OF AUTOMOTIVE ENGINEERS. National automobile and production meeting. Sheraton-Cadillac Hotel, Detroit, Mich.

Mar. 13-17. NATIONAL ASSOCIATION OF CORROSION ENGINEERS. Annual conference and corrosion show. Hotel Statler, Buffalo, N. Y.

Mar. 15-16. AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS, SOCIETY OF PLASTICS ENGINEERS. Plastics for tooling seminar. Statler-Hilton Hotel, Detroit, Mich.

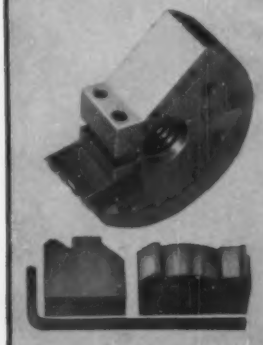
Mar. 20-24. AMERICAN SOCIETY FOR METALS. Twelfth Western Metal Congress and Exposition entitled, "Idea Center for Industry West." Pan-Pacific Auditorium, Ambassador Hotel, Los Angeles, Calif.

Mar. 22-24. PRESSED METAL INSTITUTE. Spring technical meeting. New York, N. Y.

Mar. 27-28. AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS; UNIVERSITY OF WICHITA. Third annual production institute with over-all theme of "New Frontiers in Producibility." University of Wichita, Wichita, Kan.

Mar. 28. AMERICAN SOCIETY FOR QUALITY CONTROL. Seventeenth annual quality control clinic sponsored by the Rochester section. University of Rochester, Rochester, N. Y.

Mar. 29-30. AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS. Seminar on high-energy rate forming. Sheraton Hotel, Philadelphia, Pa.



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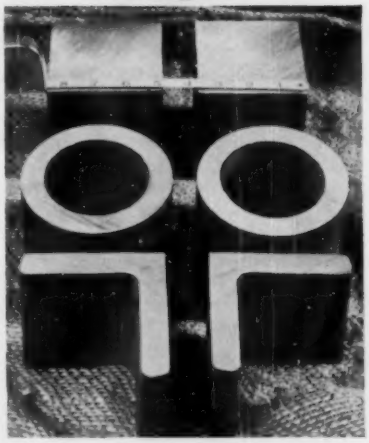

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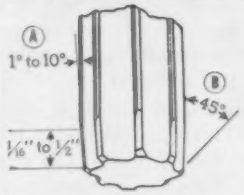
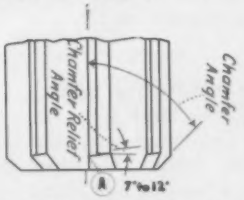


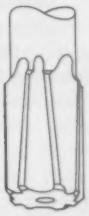
Grinding a secondary chamfer angle as illustrated (A) is often recommended. It is useful in applications where a fine finish or close tolerance is required. (B) is the regular chamfer.

KEEP IT SHARP



A chucking reamer is an end cutting tool. The cutting edges are produced by the chamfers at the ends of the lands. (A) To obtain maximum performance, the chamfers and clearance relief should be reground before excessive wear develops. Each chamfer should be ground exactly even or the tool may cut oversize.

OVERCOMING CHATTER



To end chatter in reaming, try Chicago-Latrobe's Duo-Spiral Reamer. The alternate left and right hand helixes tend to dampen cutting vibration; eliminate hogging; produce more accurate, better finished holes.

GOT A PROBLEM?

Arrange a consultation with a Chicago-Latrobe Sales or Service Engineer. His experience in hundreds of plants can lead to a quick solution of your problem.

Best tip of all...

ASK YOUR DISTRIBUTOR FOR . . .

Chicago-Latrobe REAMERS

DRILLS • REAMERS • END MILLS
COUNTERSINKS • COUNTERBORES
CARBIDE TOOLS • SPECIAL TOOLS and
"LO-TORK" CHIP BREAKER DRILLS

Write Chicago-Latrobe or call your distributor for CATALOG No. 60. Sixty-eight pages of illustrated listings and specifications—including prices.

CHICAGO-LATROBE
434 West Ontario Street Chicago 10, Illinois

NEW IDEAS IN COPPER ALLOY ROD AND WIRE

Interesting things happen when you add a spot of zirconium or chromium to copper—four high-conductivity coppers that boost production, cut cost of machining—even plain old free-cutting brass rod is going fancy.

There's a quiet revolution going on in copper metallurgy. Research and development teams are expanding the useful knowledge of copper and copper alloys in an effort to define the properties most suitable for specific engineering applications.

STABILITY at elevated temperature, combined with good electrical conductivity, is probably a combination most sought after by design engineers and by our industry's research teams. Two alloys are now commercially available, and the alloy systems are unique. Chromium copper and zirconium copper are heat-treatable alloys with good stability of mechanical properties up to temperatures in the order of 600 F.

CHROMIUM copper in the fully heat-treated condition following a solution anneal will exhibit properties combining a tensile strength of about 75,000 psi with conductivity of approximately 80% IACS. Zirconium copper has good stability characteristics at elevated temperatures and conductivity of 90 to 95% IACS; the strength properties developed by heat treating are, however, somewhat lower than chromium copper.

SEVERAL other heat-treatable copper alloys with intermediate properties are gaining recognition in the connector and electronics fields. These alloys fall into a conductivity range of 35 to 65% IACS, with tensile strengths 90,000 to 100,000 psi. The most popular alloy systems are the copper-nickel-phosphorus and copper-nickel-silicon series with modifications for free machining or other specific requirements. These alloys have a solution annealing temperature about 100 to 200 C lower than the chromium and zirconium coppers.

THE WIDESPREAD use of panel or harness construction for linking segments of electrical control devices has made the requirement for free-cutting coppers mandatory. Screw machine shops are fabricating these connector components of various designs by the millions. Currently the most popular free-cutting coppers are leaded copper with conductivity of about 98% IACS, and tellurium and sulfur coppers at about 95% IACS. Some of these free-cutting coppers have residual oxygen and can become brittle or gassed under the usual conditions contributing to this phenomenon. All, however, can be obtained with a combination of deoxidizers or oxygen-free copper. In the case of the deoxidized variety, some slight sacrifice in conductivity will be noticed. Ordinary usage very seldom requires conductivity in excess of 90% IACS – and this presents no problem for these coppers.

ALL of these coppers can be cold worked without too much trouble. They can be supplied in a suitable wire temper for cold heading and secondary operations designed around the basic alloy system. Up to now there has not been too much interest in these alloys for wire forming or heading operations. Close dimensional tolerances may be the reason for the reluctance of the heading people to get into the electrical connector business. Alloys are available with the ductility and mechanical properties necessary for this type of forming. It would appear that some of the products could be made more economically by cold-heading or wire-forming operations.

RECENT TRENDS have also affected the old brass and copper reliables. There can't be any product more prosaic than free-cutting brass rod; it is the cheapest of such commodities and at one time was the easiest to process—all one had to do was to extrude, draw to finish dimensions, and ship. In many cases this practice won't work today. Deep drilling, roll threading, knurling, staking, slotting, etc., have complicated the picture, but the latest efforts of the screw machine builders have laid this ghost to rest. We now hear of beta-free rod for close tolerances on deep-drilling applications. Similar grain structures, but not necessarily the same temper, are required for roll threading, knurling and staking or whenever extra ductility is needed. Along with the consideration of grain structure, it has been necessary to take advantage of the broad chemical composition range for free-cutting brass. Most suppliers divide the standard range into two parts, utilizing the lower copper range for the larger sizes that will normally be machined on the heavier, faster screw machines where chip breaking and clearing the tools are the most important considerations. This might be considered the rough, breakdown type of stock.

FOR the smaller diameters, specialization has been the watchword. Depending on specific needs, you can now obtain free-cutting brass rod with all-alpha, fine-grained structure or an alpha-beta fine-grained extruded structure, or possibly a combination of both. For certain applications you might need a coarse-grained, all-alpha structure. Lead dispersion and lead content are other variables that can and will be controlled to meet fabricating or end-use requirements.

IN the cold-heading industry, advantage is being taken of the wider selection of copper and copper alloys that is available today. The nickel silvers, phosphor bronzes, and silicon bronzes combine good ductility and high strength with excellent corrosion resistance. The whole range of common brasses has specific applications and can be tailored to various heading operations.

The research and development hopper is full of interesting new ideas and projects at Anaconda American Brass Co. It could be that we're working on something which would help solve one of your problems. Even though we don't have the complete answer, perhaps we could both reach a solution faster by pooling our efforts. Call your Anaconda representative and talk it over with him or write: Manager, Market Planning, Anaconda American Brass Company, Waterbury 20, Conn.

6050L

ANACONDA®

COPPER – BRASS – BRONZE

NICKEL SILVER MILL PRODUCTS

Anaconda American Brass Company

Field Notes

Eleven papers presented to the Pittsburgh chapter of the **Society of Carbide Engineers** during the past year under its education program have been edited and bound in book form. These articles and their authors are as follows: "A Milling Torquemeter of Planetary-Gear Design," J. R. Roubik; "Modern Drilling Technology," Carl J. Oxford, Jr.; "Man Made Diamonds," E. L. Sinclair; "Machinability Theory and Application," William Pentland; "Chips, Materials and Machines," Albert B. Albrecht; "Cutting Fluids," W. G. Thomas; "Man Made Industrial Diamonds," J. T. Elovich; "Applications and Limitations of Metal Removal Techniques in Aircraft and Missile Manufacturing," Michael Field; "The Machining of Ultra Strength Alloys," John Maranchik; "Tool Nomenclature-Table of Equivalents"; and "Solving Boring Problems," Frank L. Brugger. The 83-page book can be purchased for $5 by writing Mr. Harold C. Shirley, Treasurer, Pittsburgh Chapter No. 10, Society of Carbide Engineers, Edgewater Steel Co., Allegheny Ave., Oakmount, Pa.

acquisitions

In a major expansion to the West Coast, **Tenney Engineering, Inc.**, Union, N. J., has acquired **Harvick Mfg. Co.** and **Harvick Machine Corp.**, South Gate, Calif. The companies, which will be combined and operated as one subsidiary under the name of **Harvick Mfg. Co.**, are, according to Saul S. Schiffman, chairman of the board, expected to add $1,000,000 to Tenney's sales in the first year. The plant will produce environmental simulation equipment as well as continuing with the design and manufacture of aluminum and steel missile and airplane handling equipment.

McKay Co., Pittsburgh, Pa. manufacturer of welding electrodes, welding wires, chain and chain products, has acquired **Automatic Welding Co.**, Waukesha, Wis. Automatic Welding manufactures equipment used for all types of automatic welding but specializes in making welding equipment for automatic hard surfacing and machines for specialized automatic welding applications such as fabricated pipe elbows, oil storage tanks and foundry flask sections. The acquisition, according to James C. McKay, president, goes hand-in-hand with the $1,200,000 expansion program for the York, Pa., manufacturing facilities announced last year.

association news

R. G. Kenly, president of the **American Zinc Institute**, and Hartley Burgess, president of the **American Hot Dip Galvanizers Assn.**, have announced that the membership of both organizations has voted to launch a joint research and development campaign to expand the uses of hot dip galvanizing. The purpose of the cooperative campaign, as revealed in a joint statement, is to stimulate research and experiment by architects, engineers and technical experts in many fields where hot dip galvanizing is not being utilized to its fullest potential, as well as to encourage product improvements.

Harold Massey, managing director of the Gas Appliance Manufacturers Assn., has been elected chairman of the standards council of the **American Standards Assn.** for a one-year term beginning Jan. 1, 1961. Elected to serve as vice chairman was E. O. Mattocks, director of technical services, American Petroleum Institute. Those elected to serve on the board of review for 1961 are Richard B. Belford, Industrial Fast-

Recent help-wanted advertisement appearing in Minneapolis Morning Tribune.

TOOL ROOM
JIG GRINDER
ON NEW MOORE JIG GRINDER
NITES—TOP PAY & OVERTIME
American Mach. & Tool Co.
205 NORTH 3RD ST. FE 9-7241
TOOL & MOLD MAKER

Why this plant can afford top pay and overtime on its Moore Jig Grinder

This versatile precision machine has been *a night-and-day* moneymaker throughout the twenty-odd years since Moore pioneered the principle of Jig Grinding. Ask any Moore owner! Ask Carl A. Berg, for example, who ran the above advertisement for his new No. 3 Moore Jig Grinder in a Minneapolis newspaper recently.

That's because Jig Grinding is the happy answer to the ever-present problem of accurately locating and grinding holes, contours and surfaces to size in hardened steel and carbides. The No. 3 now holds tolerances to *less than a tenth!* See positioning accuracies under photo of the machine at right.

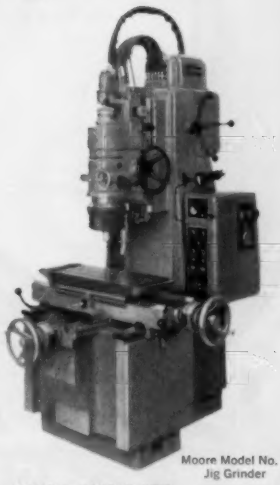
Mating parts such as punches and dies can be finished concurrently and made to figures by Jig Grinding with the Moore, rather than just "to fit." Service life is greatly increased, because fits are more accurate, alignment is assured and surface finish is improved.

The flexibility and accuracy that make it a "must" for toolroom applications also make the No. 3 Jig Grinder a key machine in model, experimental, precision machining, and development work. Here, prototype and critical parts are quickly produced to the closest tolerances required.

When users offer top pay and overtime to operators of this busy machine, *they do so because it earns that kind of return* ...for toolroom, production, experimental laboratory and inspection assignments.

May we prove it to you?

MOORE SPECIAL TOOL COMPANY, INC.
732 Union Avenue, Bridgeport 7, Conn.



Moore Model No. 3 Jig Grinder

ACCURACY OF POSITIONING

LONGITUDINAL TRAVEL:	
Greatest error in any inch	30 millionths
Greatest error in 18 inches	90 millionths
CROSS TRAVEL:	
Greatest error in any inch	30 millionths
Greatest error in 11 inches	90 millionths
SQUARENESS:	
Compound slide	60 millionths
Travel, spindle housing	90 millionths in 13"
Travel, spindle	90 millionths in 3½"

HOLES, CONTOURS AND SURFACES. Moore's authoritative book of 421 pages, 495 illustrations on tool, die and precision parts production. Includes these fine chapters: "Jig Grinding Principles and Applications," "Jig Grinding Holes," and "Jig Grinding Contours." $6 in U.S.A., $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM
JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

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eners Institute; Hendley Blackmon, National Electrical Manufacturers Assn.; J. S. Fassett, American Hotel Assn.; C. M. Heinen, Society of Automotive Engineers; J. W. W. Sullivan, American Iron and Steel Institute; C. W. Franklin, Electric Light and Power Group; and E. O. Mattocks.

Pressed Metal Institute has announced the appointment of Jefferson D. Keith as managing director. Keith served most recently as administrative assistant for the American Pulpwood Assn. and has previously filled posts with the National Petroleum Assn. and W. A. Penrose & Associates.

awards

Karl Rannels, American Metal Market, has been given the annual recognition award by the **Aluminum Extruders Council** for "his excellent efforts and accomplishments during 1960 in improving the dissemination of vital and pertinent information regarding aluminum on a daily basis."

expansions

A new Canadian company has been formed by **Wheelabrator Corp.**, Mishawaka, Ind., and named **Wheelabrator Corp. of Canada, Ltd.** Successor of the **Canadian Div. of Wheelabrator Corp.**, the firm was organized to handle expanding sales and fabricating activities for all provinces in Canada. Wheelabrator supplies airless blast cleaning equipment, abrasives, and dust and fume collection systems.

A Freeport, Pa., manufacturer of carbide dies — **Oberg Mfg. Co., Inc.** — has formed a partnership with **Joseph Sankey Co., Ltd.**, London, to service foreign markets. The new firm, **Oberg-Sankey, Ltd.**, is located at Dudley, England, near Birmingham. Production will start in April.

new activities

Difficult-to-machine materials such as tungsten and high-strength steels and new and novel processes for removing metal will be studied by **Metcut Research Machining Data Center,** a new department formed by **Metcut Associates, Inc.**, Cincinnati, Ohio. The center—organized to serve as a national center for the collection, analysis, correlation, dissemination and interpretation of machining information; to assist science and industry through better knowledge in this area; and to provide facilities for the experimental development and application of machining and machinability information—will be directed by Norman Zlatin and his assistant, John Maranchik, Jr.

A new tool and die manufacturing plant has been opened in Detroit, Mich., under the name of **Fischer Tool & Die, Inc.** All administrative positions are held by former officials of Mercury Tool and Die Co., Inc., also of Detroit. Top management of the new concern is Harold P. Fischer, president, who was vice president and general manager of Mercury, and George Fischer, vice president, formerly president of Mercury.

new facilities

R. C. Mahon Co., Detroit, Mich., has announced the completion of the first phase of a multimillion dollar seven-year modernization program at its Structural Steel Div. The company has installed a numerical positioning controlled drilling machine, built a large paint conveyor system and installed modern high-speed welding equipment.

New ARMSTRONG Swivel Pad can't come off

Now ARMSTRONG deep throat "C" Clamps have the new (Pat. apd. for) ARMSTRONG Ball-joint Swivel Pad. This "C" Clamp pad, developed by ARMSTRONG Engineers, is tougher than any on the market. Rigorous testing in our own plant first proved this fact, and field tests in factories throughout the country have confirmed our own test results.

Here's Why it's STRONGER . . .

The lip of the opening in the ARMSTRONG Ball-joint Swivel Pad is undercut so that when the ball of the screw is inserted, and the lip is permanently forced down, a solid steel wall is formed, inside the pad cavity, completely encircling the ball.

This wall of steel makes it impossible for the pad to come off the screw during normal use. In fact, our tests have proved that it is virtually impossible to intentionally knock the pad off with a hammer —yet the pad is free to swivel through an arc of approximately 40°.

Call your ARMSTRONG Distributor

Your ARMSTRONG Distributor can offer delivery from stock on this "400-Series" deep throat, drop-forged "C" Clamp with the new Ball-joint Swivel Pad. He also carries in stock the other styles of clamps in the ARMSTRONG Line—the broadest line of drop forged "C" Clamps.

ARMSTRONG BROS. TOOL CO., 5257 W. ARMSTRONG AVE. CHICAGO 46, ILLINOIS

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technical shorts

High-Energy Particles—A $600,000 bubble hamber to be used in observing atomic collisions is now being designed and built at Midwest Universities Research Association (MURA) in Madison, Wis. Invention of this device, now used extensively by atomic physicists, won the 1960 Nobel Prize for University of California physicist Dr. Donald A. Glaser.

Bubble chambers are essentially large metal cylinders filled with a superheated liquid just at the boiling point. Charged atomic particles passing through the chamber start the liquid boiling, leaving lines of bubbles behind them. In this way, atomic particles can be observed just as a high-flying jet plane is observed by its vapor trail.

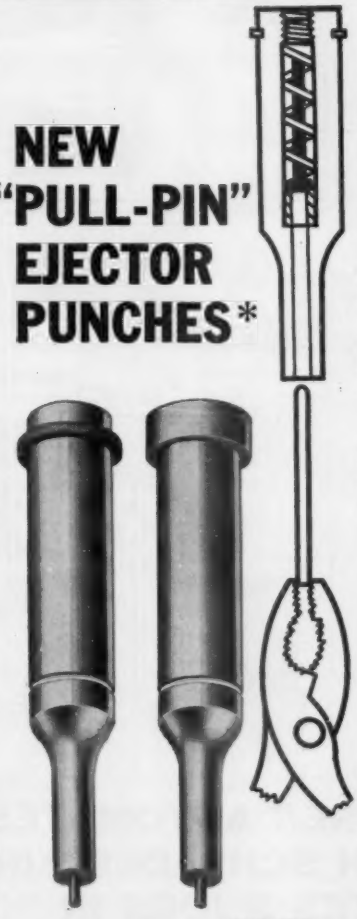
Now in the design stage, the chamber is a stainless steel cylinder 30 inches in diameter. It will be filled with liquid hydrogen (boiling point –400 F) and surrounded by a 150-ton magnet which will bend the paths of the charged particles moving through it. Variations in temperature will be accomplished by increasing or decreasing pressure on the liquid. In operation, a piston which applies the pressure will withdraw, allowing the liquid to become superheated for approximately 0.01 sec. During this period bubbles will be photographed by high-speed cameras. Subsequent movement of the piston will raise the boiling point causing a cessation of bubble formation. Alternating movements of the piston—with which the camera is synchronized—will enable MURA to photograph and define the paths of high-energy particles.

Filter Materials—A new method of manufacturing pleated filter materials which offers high uniformity and close tolerances, as well as substantial production economy has been devised by the Twin Coach Co. of Buffalo, N. Y. The method is based on the use of a machine that folds metal and other materials into corrugated shapes in contrast to the traditional method of forming corrugations by drawing. Key element in the process is a cam-controlled action which moves the forming dies in both the horizontal and vertical plane. The new method permits the pleating of micronic metal cloth with a minimum of impact upon its original characteristics. No distortion of micron capability occurs because very little stress is introduced to the material. Some micronic material that has been pleated has had as many as 500,000 perforations per square inch.

The technique has proved itself effective in pleating a wide variety of filter materials, including steel, copper, brass, aluminum, cloth, felt and paper.

Vinyl Pipe Lining—Seamless, corrosion-resistant vinyl linings can now be applied to interior walls of steel pipe with a process developed by Lithcote Corp., Melrose Park, Ill. A special roller-coater is used to apply a vinyl plastisol coating to the interior walls of pipe ranging from 3 inches to 36 inch diam and in lengths up to 60 ft. The plastisol lining thus applied is from 1/16 to ⅛-inch thick. Plastisols used in the process are formulated by Michigan Chrome & Chemical Co., Detroit, and are based on Geon vinyl materials manufactured by B. F. Goodrich Chemical Co., Cleveland.

NEW "PULL-PIN" EJECTOR PUNCHES*



CUT GRINDING TIME 90%

With no special tools—*just pliers*—you can pull ejector pins from punches *in seconds!* Pull-Pin Ejector Punches eliminate the costly procedure of disassembly of punches or removal of stripper plates.

Just pull the pin, depress the stripper, sharpen the punches, push the pin back in. Even closely grouped punches are prepared for grinding instantly.

NEW CATALOG shows round and shaped punches and dies. Information is provided on engineering specifications, material and heat-treating, punch and die clearances, blanking pressures, etc. Ask your distributor, or write direct.

*PAT. PEND.

New line includes Regular, Medium and Long lengths in Ring and head-type punches; complete range of press-fit and head-type stripper bushings; quill punches in 3 sizes.

RING PUNCH & DIE DIVISION
OF THE PRODUCTO MACHINE COMPANY
JAMESTOWN, NEW YORK

PRODUCTO

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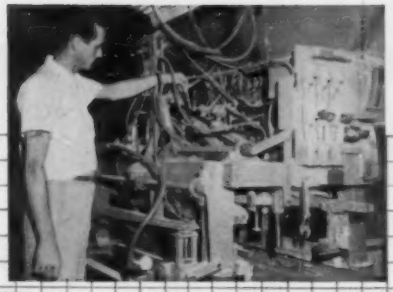
The Lane Furniture Company of Altavista, Virginia, broke its cedar chest production line into groups of operations for air-automation. One of the many circuits, shown here, was designed with quality Schrader components to brand the chest tops with a trademark, bore hinge recesses, and perform vertical and horizontal gang drilling operations. All three jobs are completed in less than 30 seconds!



1. Schrader air cylinder pulls gauge mechanism clear and releases finished piece to conveyor. Electrical RAISE signal comes from switch that indicates step 4 completed. As soon as completed piece is clear, another switch actuates LOWER coil of double solenoid valve.

2. Two cylinders set side clamp when electrical signal from switch on gate indicates that new piece has been conveyed into proper position.

3. Typical boring head is operated by pull-type single-acting cylinder. Electrical signal comes from switch on side clamp stop.

4. Individual cylinders apply branding heads. Cycle starts with side clamping. Length of branding cycle is controlled by electric timer.

MANUFACTURER AUTOMATES PRODUCTION LINE WITH SCHRADER AIR CIRCUITRY... COMPLETES 3 JOBS IN 30 SECONDS

If your plant has production lines too long, unwieldy and costly to compete effectively, take a tip: Break your entire manufacturing sequence into logical *groups* of jobs. Then develop air-powered and air-controlled machines to perform each group in sequence. This company did, and now has versatile, fast, and economical production. *You already have air.* Expand its uses with versatile Schrader Air Products and discover true efficiency.

There is a fully stocked Schrader Distributor nearby . . . staffed with experts to help you solve any air circuitry problem. Consult the Yellow Pages or write:

Schrader®
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A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
462 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS

Tech Digests

Welding Doubles Crane Capacity

The author's company was faced with the task of having to handle a weldment which was too heavy or too large for the equipment on hand. The job consisted of building a box girder which weighed about 44 tons, and the heaviest overhead crane was rated at only 20 tons. A check was made on the design of the crane runway and girders in the overhead crane, and it showed that the crane runway was strong enough to carry the 45 ton load.

The check also proved that the hoist was strong enough if a change was made in the gear ratio of a pinion and bull gear, and if a top cover plate was added to the riveted box girders of the overhead crane. Arc welding the additional cover plate made it economically feasible so our company went ahead and completed the job.

In redesigning the crane girders, it was found that the girders were sufficiently strong to carry the 44 ton load, but being a riveted girder the top 9/16 inch cover plates were unsupported by the diaphragms. The concentrated wheel loads on the rail which were transmitted to the 9/16 inch cover plate were too great for a safe design.

This led to the design of an additional top cover plate of 3/4 inch in thickness and required a 1/2 inch continuous fillet weld to connect the two cover plates.

The length of these box girders on the overhead crane was a little more than eighty feet long, and there was considerable concern about placing two 1/2 inch fillet welds on the sides of the 3/4 inch cover plate. What would the shrinkage and distortion do to the riveted box girder? It was feared that the rivets might shear and that all the camber might be lost.

The problem in the welding department was to find a way to cut down the weld size to help minimize shrinkage. After careful consideration, it was decided to make use of high-tensile weld metal which is readily available through arc-welding electrodes. The allowable safe load on a 1/2 inch fillet is 4800 pounds per lineal inch, based on a 60,000 psi tensile strength material. By going to an E11018 electrode, which provides 110,000 psi weld metal, the size could be reduced to a 5/16 inch fillet and the weld could be made in one pass. The heat input would be much less and the shrinkage would be minimized proportionally.

Shrinkage was checked by measuring the overall length of the girders before and after welding. The length of the girders was 80 ft. 9 inches and each girder shrank about 9/16 inch in length, or 0.002 inch per foot. This amount of shrinkage would have little effect on the rivets.

Shrinkage in a weldment is a function of the cross-sectional area of the weldment to the cross-sectional area of the weld. That is, as the ratio of the cross-sectional area of the weld to the cross-sectional area of the weldment increases so will the shrinkage increase.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Reducing the weld size from 1/2 inch fillet to 5/16 inch fillet reduces the cross-sectional area of the weld from 0.125 sq in. to 0.49 sq in. This is a reduction of 2 1/2 times; therefore, the shrinkage reduction should be in the order of 2 1/2 times less.

The immediate cost saving resulting from the change from E6015 electrodes to E11018 electrodes was in the order of a 33 1/3 percent savings. The needed 387 feet of welding took 38 man hours to complete, which is an average of little over ten feet per hour for the 5/16 inch fillet weld. The weld speed for the 1/2 inch fillet would have been six feet per hour for that particular job.

The immediate saving derived from the use of E11018 in place of E6015, made possible through the use of arc welding, can be multiplied many times if we take into consideration what the cost would have been if the crane girders had to be reinforced with a riveted design.

This saving would be in the order of thousands of dollars. As it was the total direct labor charge to reinforce this crane, which meant taking down the trolley, changing the gear ratio and replacing the trolley, only amounted to $921.

Based on a paper "Rebuilding a 20-Ton Box-Girder Crane To A 45-Ton Capacity" by Y. T. Smith, presented at the AWS National Fall Meeting 1960. Sponsored by American Welding Society, 33 W. 39th St., New York 18, N. Y.

Standardization Improves Reliability

Standardization is unique in that it simultaneously increases reliability as it decreases cost and schedule time. It is becoming more and more important for a number of reasons coming from five different areas: one, calibration, two components, selection and testing, three, assembly and subassembly design, four, data of collection and analysis, five, manufacturing processes and controls.

Trouble areas of calibration exist in the vital categories of measurement: dimensional, optical, temperature and humidity, shock, vibration, force, microwaves, radio frequency, electrical, pressure, vacuum flow, infrared, and radiological. Advanced programs have moved forward by expensive duplication of effort, expensive establishment of make-do company standards, that are worthless on a national basis, where interchangeability and compatibility are the essentials of economic and reliable production. An error of one millionth of an inch in the bore hole of a gyro can cause an error of 0.03 degree per hour drift which is sufficient to cause a moon shot to miss. Calibration procedure

needs standardization. With gaging instruments, a pressure as low as six ounces with a contact diameter of ⅛ inch will deform a steel block ten millionths of an inch. Differences in the methods of gaging give different measurements. There are a multitude of considerations that must be standardized to attain uniformity of measurements.

For component selection and testing present specifications on reliability are extremely rigorous. The cost of testing each part type including the cost of manpower, fixturization, running expenses and the price of destroyed parts mounts up. Standardization is the answer. The same applies to assembly and subassembly designs. For example, by effort it was possible to reduce the number of transistors from 20 to 12 types and the number of diodes from 40 to 28. By juggling and redesign and informal discussions with engineers, 40 standard boards were made to serve over 2000 circuit applications, roughly a 20 percent standardization. Total savings, including testing, purchasing and so forth, was estimated at about five million dollars. Cost gains are also attained by ordering large lots of parts, and by reducing tooling costs when standardized assemblies and subassemblies are used.

Data selection and analysis can be made more standard than it is. With standardized data and reporting forms, anyone can read the forms with no chance of misinterpretation or error. With standardized forms data dissemination and corrective action can be undertaken with almost no difficulty resulting in two-fold savings: one, there is no time wasted in getting things rolling; and two, the need to formulate new procedures and approaches for each project disappear. Standardized forms are also easier to use with automatic data processing.

Manufacturing processes and controls should be standardized. Once a part has been developed and tested, any change in process or control can invalidate test results. With standardization of manufacturing processes and control, it is possible to trace back and find the cause of unreliability.

To maintain this nation's lead it is necessary to get maximum value for the cost of production. Standardization can lead to low-cost, highly reliable products.

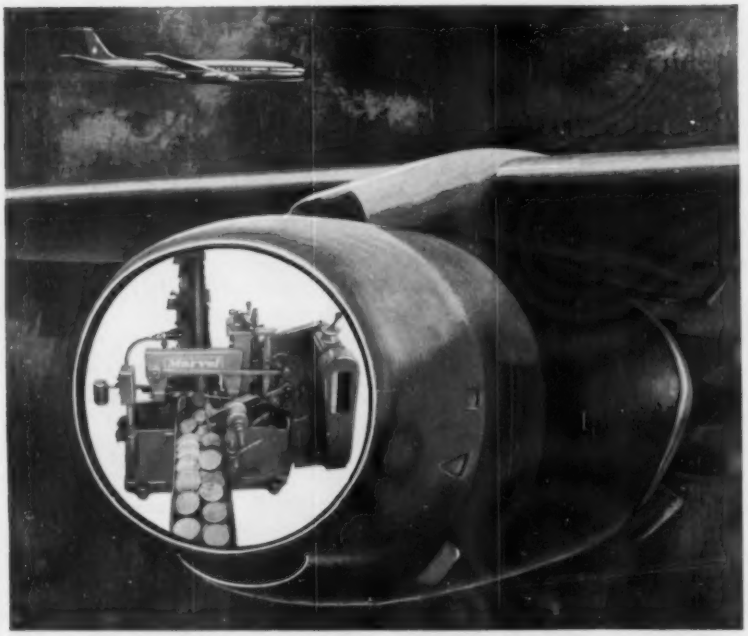
Based on "Standardization—The Thrifty Road to High Reliability" by Frank McGinnis, Sperry Gyroscope Co., Great Neck, N. Y. Presented before the Eleventh National Conference on Standards sponsored by American Standards Association, 10 E. 40th St., New York 16, N. Y.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Quality Standards in a Manufacturing Plant

A complete specification system consists of four basic types of documents: product specifications, process specifications, drawings, and inspection specifications. The specifications should clearly and completely describe the physical requirements and should contain, or reference, the procedure for verifying that the requirements have been met. When standardized, the specification should be approved and accepted by the consensus of its users.

In preparing specifications, sharp attention needs to be given to statistical detail. Each document should be clearly identified and should follow some rule of uniformity as to format and content. The preparation and review of the application of specifications is a staff quality control function. The achievement of quality in production is



TOO SLOW ?

Emphatically not! . . . ask any visitor to the 1960 Machine Tool Exposition who watched a Marvel No. 6 Hack Saw Machine cut-off 3¼" diameter 1018 steel in 27 seconds! This Saw, costing less than $3000, was actually cutting at the rate of 18 square inches per minute!

We made the above demonstration merely to "match" what we believe to be the impractical demonstrations of some of our competitors. OUR visitors were warned that continuous cutting at this speed is economically impractical if maximum blade life and accuracy (after the first 20 cuts) are desired. They were told that the material could be cut day in and day out, at the rate of 8 square inches per minute with tool cost of approximately 1 cent per cut.

Our point? Marvel No. 6 and No. 9 Series Heavy Duty Ball Bearing Hack Saw Machines, as we build them today, have speed to spare. And they offer the most accurate, economical cut-off at the lowest initial investment.

Ask your Marvel Dealer to arrange a sawing demonstration—on your own work—if you wish. Because we have consistently built both Hack Saws and Band Saws for more than 40 years, you will get an unbiased recommendation.

Catalog C60 illustrates and describes the complete line of Marvel Sawing Machines. Write for your copy.

MARVEL Metal Cutting SAWS

BETTER MACHINES BETTER BLADES

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a manufacturing line responsibility with the detailed control procedures carried out by a line quality control group. The achievement of quality in manufacture depends upon the skill and conscientiousness with which standards are prepared and applied.

From "Quality Standards in a Manufacturing Plant" by Charles A. Bicking, The Carborundum Co., Niagara Falls, N. Y. Presented before the Eleventh National Conference on Standards sponsored by the American Standards Association, 10 E. 40th St., New York 16, N. Y.

Value Analysis

Value analysis is two things—first, it is a package of techniques that helps identify unnecessary costs and develop lower cost methods of the required functions; and second, value analysis is a full-time service activity staffed by competent specialists, whose job is to help line personnel all areas of the business. As a package of techniques, value analysis can offer professional, organized, systematic approach to assist in making better decisions in terms of the value in the design, procurement or manufacturing stage of the product cycle. Value improvements are almost always the result of combined or teamwork action of two or more of the three business functions. When engineering, manufacturing or purchasing decisions that bring about better value have been made, the resultant components can be used as a basis of standardization in the plant.

Seven examples are given to illustrate the importance of cost reduction contributions from many areas. Value analysis techniques and value specialists can serve responsible line functions by providing both tools and guidance in reducing product costs.

From "Value Analysis Aids Teamwork Cost Reduction" by Frederick S. Sherwin, Raytheon Co., Waltham, Mass. Presented before the Eleventh National Conference on Standards sponsored by the American Standards Association, 10 E. 40th St., New York 16, N. Y.

Management Practice

Past is prelude, and a review of management practice, 1950 to 1960 can indicate future developments. In previous times, many yardsticks were in common use for management measurement of performance. Among these are accounting, to provide information on financial and cost performance, which is still used, another is work measurements, to record the time aspects of output. More yardsticks than these are needed and are being developed. Executives of this generation realize that there is no stronger foundation for a decision than factual data. General Electric's "key result areas" are a noteworthy contribution to development of

New optical measuring instrument...

For precision work to .0002"

- No moving parts
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- Eliminates gauge blocks, end rods

The new VERNAC direct reading optical measuring instrument indicates longitudinal, lateral or vertical position of the table of any machine tool without benefit of mechanical connections. It can be incorporated in new equipment or tools already in service.

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*The scale is a replica of a master certified by the U.S. National Bureau of Standards to .0001" maximum error over its entire length.

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yardsticks. Seven accomplishments are spotlighted: profitability, market position, productivity, product leadership, personnel development, employee attitudes and public responsibility. However, even these developments cannot obscure the fact that lack of measurability is a common characteristic today. What is started today as a beginning trend promises the likelihood of substantial progress soon. Disregard of facts, which was once the characteristic of executive strength, now indicates managerial weakness. As the management cycle of planning, operations and review develops, it seems possible to distinguish a trend from management control to management service. At the same time control systems depending on data processing equipment are evolving from military prototypes. One of these, "management operating systems," developed by IBM will include forecasting, materials planning, inventories, production scheduling, dispatching and evaluation. Automation of production activities may be one of the most significant developments. In general, the previous decade has left many unsolved problems, but also deposited them in a climate which should bring progress that may dwarf past achievements.

From ASME Paper No. 60-WA-69 "Practices in General Management—Measurements and Control," by A. W. Rathe, Associate Professor of Management Engineering, New York University. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

Industrial Management Education

For an understanding of achievements to date in industrial education, and for types of future efforts, management education over the decade of the 50's was carefully studied and reviewed. During this period, the accelerated rate of environmental change has called for an accelerated rate of educational change. The emphasis upon long-term strategy and planning has called for more emphasis upon diagnosis. Company after company has become aware of the shortage and inadequacies of managers and has begun education programs. In some cases, however, an actual deterioration of a work situation resulted from educational programs. The expansion of the size of corporations has continued, bringing with it problems of complexity, decentralization, and integration. As education and training continue to cope with this situation, more of an attempt is made to evaluate the contribution of management training. Questions arise regarding scientific management and human relations, or in other words, efficiency of method, versus motivation of people. Opinions on the effectiveness of training vary widely. And, as a matter of fact, there is little trend toward scientific measurement or any kind of objective evaluation. Results to date indicate a variety in scope, content, method and achievement.

From ASME Paper No. 60-WA-107 "Management Education—Industrial" by F. F. Bradshaw, Management Consultant, Croton-on-the-Hudson, N. Y. The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

Equipment-Performance Analysis

Allowances are usually made for equipment downtime to establish realistic output attainment figures. The items involved in nonproductive time are usually: one, potential equipment utility, two, reduction of equipment downtime, and three, equipment to facilitate study of downtime. Efforts to increase equipment utility are usually only as effective as the completeness of the information. Adequate data and systematic analysis of these data must

LOCATION TOLERANCES OF .0004"

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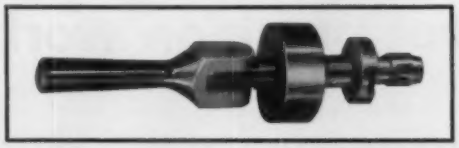
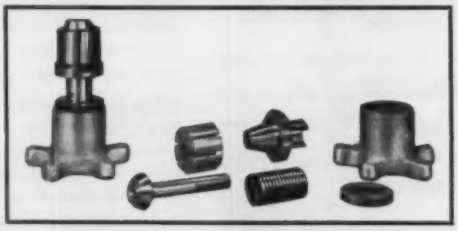
Gain accuracy—Save time—Avoid errors in loading or unloading work from fixtures! Speedgrip expanding locators are *guaranteed* to repeat fixture location within .0004". Nationally known customers find Speedgrip locators indispensable for holding required tolerances! Assures easier loading and unloading of work.

No. 0 Speedgrip Locator with cam lever actuation. With corresponding bushings, this locator will accommodate bores from 1/2" to 3/4" dia.



No. 2 Locator with hand knob actuation. With expansible bushings, this locator can be used for bores from 1" to 2" dia.



This No. 5 locator can be supplied for either wrench or draw bar actuation. Has precision ground pilot on under side of flange for mounting to fixture. With expansible bushings, this locator can accommodate bores ranging in size from 5" to 11" dia. Locators, with various means of actuation can accommodate bores, ranging from 3/8" to 11".

Some Open Territory • Dealer Inquiries Invited

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be necessary to establish reasons for equipment downtime. If downtime for maintenance can be accounted for and separated, opportunity is provided to examine conditions and to evaluate the possibility of increasing productivity through this route. If study indicates that an investment should be made to reduce equipment downtime, it is important that there be some method established to measure the results.

For these reasons, downtime monitoring and recording equipment was developed whose output is punched on tape that is processed through a converter and finally registered on punched cards. By data processing techniques, analysis can be made of downtime occurances. Having the downtime related to reasons and knowing the value of this time, in terms of net sales dollars, the justification for improvements can be evaluated. By applying missile age thinking, an all out effort to improve system performance, improvements are possible. Knowing the cause, correcting it, rather than accepting or correcting effects, can improve productivity.

From ASME Paper No. 60-WA-269, "Equipment-Performance Analysis" by James D. Quinn, E. I. Du Pont de Nemours and Co., Inc., Wilmington, Del. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

The True Meaning of Professionalism

Ever since the days of the clan there have been three great groups in society. First, there have been those who labored; they produced the fruits on which the subsistence of the clan depended. Second, there have been those who directed and governed, forming a structure which distinguished the clan from a disorganized mob, vulnerable to the vicissitudes of nature and the rapacity of neighbors. Finally, there have been the professional men.

In the days of the clan, this last group was represented by the medicine man. He held himself apart and dealt in mystery. He may have victimized his fellows, or aspired to succeed his chief. But, at his best, he served the people in ways that were beyond the needs of the moment.

As society advanced, his place was taken by the professional groups in the population, in religion, in law, in medicine. Today this has ramified into a hundred categories, the architects, the artists, the scientists, the engineers, the management consultants, the teachers at every level, the certified public accountants, in many senses the civil service.

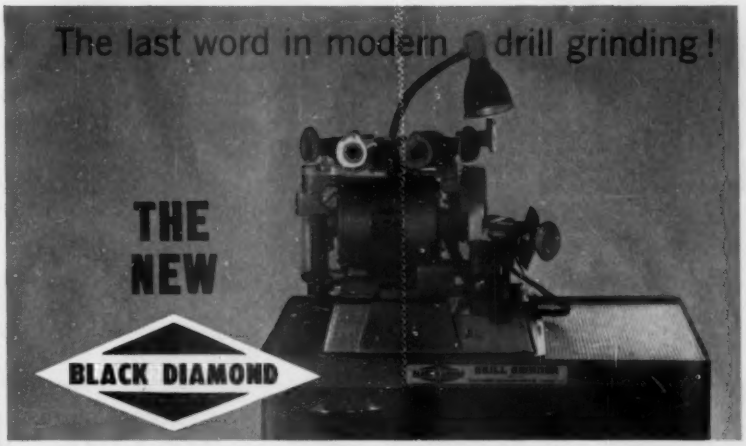
The early professions surrounded themselves with mystery and paraphernalia. They used a special jargon—some still do. They invented passwords, and wore strange and wonderful raiment. They tested neophytes and indoctrinated them in the mysteries. They claimed exclusiveness and special privileges. They created bizarre organizations for their own discipline and regulation. They boasted queer titles.

But the central theme of any true profession is ministry to the people. This is not just a service, humbly rendered. It is guidance, extended with pride and authority. Moreover, there is no vow of poverty, no turning away from the ways of the world. The profession is a part of the society in which it acts. Its members expect and intend to obtain their proper share of the world's goods, in order that they may act effectively. But they are far more interested in other things than to join a mad scramble after riches. Their object in life is to minister to the needs and welfare of those about them, by reason of special knowledge and special skills. To attain this position they expect to spend long, arduous years in special study and experience, to forego in so doing many of the pleasant things of life, if necessary to endure hardship. When they arrive, they expect to receive the respect of their fellow men which is their due, and they expect to earn a good living for themselves and their children. Their motivation is the esteem of their peers. Some, of course, are fakes and mountebanks, and not true professional men at all.

But, for the genuine professional man, what leads him on, what causes him to exert his best efforts, to aspire to greater accomplishment, is the desire to win over in the long run the respect of those fellows whose judgment and whose standards of judgment he respects.

Before I go on, let me make sure that you do not think I am blind to what goes on about me. I have known scientists, employed and considered as such, that did not know enough to hold down a good job as a garage mechanic. I have seen lawyers mulct their own clients and physicians I would not let treat my poodles. I know there are executives in high posts who arrived there by flattery and chicanery. I have watched business men violate every principle of management carried in the books. And I read the papers, and have still a reasonable, but qualified, confidence in my fellow men.

Based on a paper "Business Management—a Profession" by Vannevar Bush, Chairman of the Board, Merk & Co., Inc. Presented at the 10th semi-annual meeting of the Manufacturing Chemists' Association, Inc., 1825 Connecticut Ave., N.W., Washington 9, D. C.



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HOW TO BECOME AN EXPERT IN SOLID CARBIDE BUR SELECTION

Solid carbide burs are universal roughing and finishing tools. Atrax, manufacturing the most complete line, can furnish a size and shape to accomplish practically any metal removal or finishing operation.

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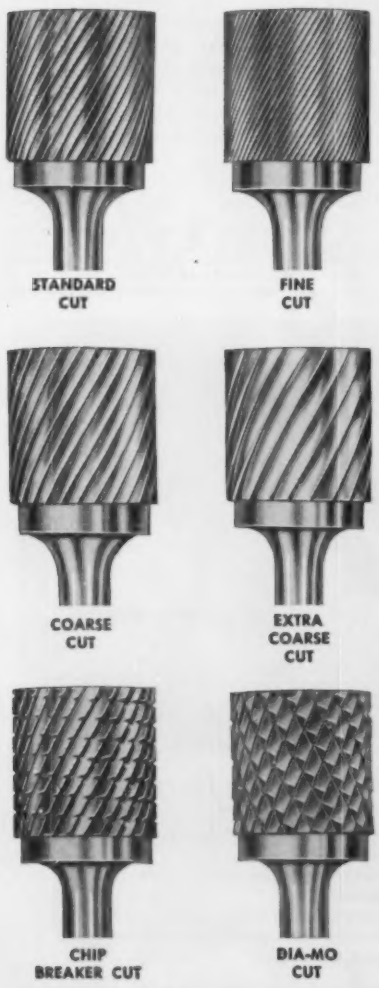

Applying the Chip Breaker or Dia-Mo cut to the other types offers 11 different available cutting combinations for each size and shape of bur.

14 DIFFERENT SHAPES

To make burs one of the most versatile of metalworking tools, 15 standard shapes—181 different sizes, each in the 6 cuts, make available a total of 1086 different burs for a large variety of metalworking requirements.

PRODUCTION VERSATILITY

Atrax Burs, because of their controlled tool geometry and precision uniformity, are recommended for use on virtually all materials.

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Bur selection depends on the operation and material to be cut. Bur speed also depends on these factors and on diameter of bur used.

STANDARD BUR SETS

Atrax Solid Carbide Standard Bur Sets are also available through your dependable Atrax Distributor.

Complete engineering information on bur selection and use can be found on page 12 of the 148 page Atrax Catalog.

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There is an Atrax Precision Ground Solid Carbide Tool engineered to every material and job application.

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THE ATRAX COMPANY

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Engineering Bookshelf

CREATIVE ENGINEERING DESIGN—*By Harold R. Buhl: Published by Iowa State University Press, Ames, Iowa. Price $3.95 195 pages.*

Starting with Oliver Wendell Holmes' observation that there are one-story, two-story and three-story intellects, this book attempts to build an escalator for engineers languishing on the lower levels. Author Buhl—quite obviously a third-story man himself—believes that failings of most designers can be attributed to their attempts to solve new problems in terms of old solutions. Thus, their approach to design problems is that of an unending modification of previous accomplishments, and their thinking is done in terms of the status quo.

Stressing the fact that modern industry requires an ever-increasing number of creative engineers—men who can innovate where others modify—the author outlines the procedures used by top-level men. Methods whereby ideas can be incubated, analyzed and correlated are delineated in a witty and relaxed style.

Cartoons used liberally throughout the book are tied to the text in such a way that the book is not only informative, but entertaining as well. Added to these are quotations from an array of creative geniuses such as Ford, Kettering, Shaw and Spencer. Intended to inspire the reader while lending support to the author's arguments, these are unusual in that they provide diversion from the text but not from the discussion at hand.

This book's capacity for sparking the imaginations of engineers is, as yet, an unknown quantity. It is certain, however, that it will be useful to engineers at all levels—the third included.

INGENIOUS MATHEMATICAL PROBLEMS AND METHODS—*By L. A. Graham. Published by Dover Publications, Inc., 180 Varick St., New York 14, N. Y. Price $1.45. 237 pages.*

For practical application and mental gymnastics, 100 mathematical problems have been collected in an attractive, well-made paper back edition. Composed of two sections, the problems require 53 pages, the solutions and explanations a total of 176 pages.

Problems used in this book were selected as the most interesting of those published in the *Graham Dial* over a period of 17 years. The first problem —the checking of holes with plug gages —was originated by Edward C. Varnum, a mathematician at Barber-Colman, and a regular contributor to THE TOOL AND MANUFACTURING ENGINEER. Other problems involve such exotics as square-root extraction without a log table, slide rule or other calculation. All in all, the book should be profitable and enjoyable for tool engineers who use mathematics in their work, or simply for diversion.

INVOLUTE SPLINES, SERRATIONS AND INSPECTION—*Published by The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. 108 pages.*

Standards of geometry, nomenclature and dimensional relationships of splines and serrations are established in this book. A revision of an earlier work, this book clarifies usage and definition while explaining effective dimensions, and control of fits. All main spline tables have been extended to 60 teeth and examples of drawing data showing recommended methods of dimensioning have been expanded.

PUSH BUTTON *Speed Selection*

from  **to**  **in seconds**

or to *any* intermediate speed, *instantly*

Just push a button and watch the large tachometer dial on the headstock!

It's that easy!

The work is done by a motor driven speed changer. It accelerates or slows the lathe to any desired speed in seconds. With a 10:1 ratio, this new variable drive makes it easy to select from a wide range of speeds—200 to 2000 rpm in direct drive and 40 to 300 rpm in back gear.

Maximum stability and smooth power transmission are assured because the drive unit is oversized. All pulleys and shafts are fully supported (eight bearings). Double V-belts throughout the drive eliminate slippage and deliver full power to the spindle. Because of this rigidity and extra pulling power, this lathe will take heavy cuts at all speeds and precision finish cuts at high speeds.

It is a precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

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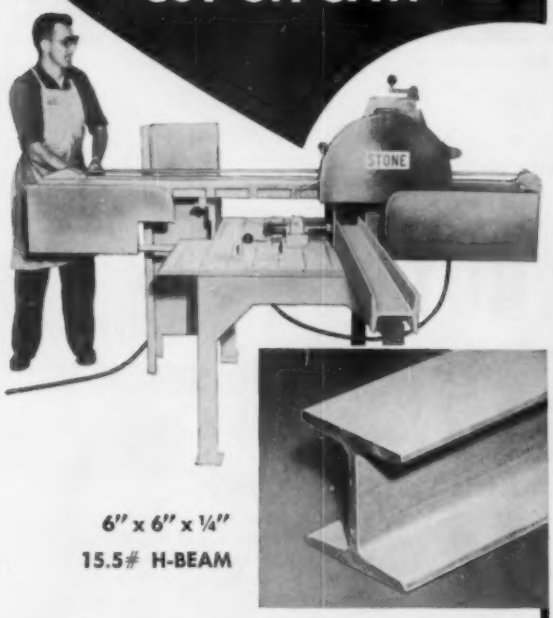
Just 33 Seconds to Cut 6" H-Beam

STONE SS-100-LR TRAVERSE TYPE CUT-OFF SAW



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15.5# H-BEAM

This 6" structural H-Beam is cut in a single, 33-second pass at the Syracuse Engineering Company. For precise, square and clean cuts with economy of speed and wheel wear, Syracuse Engineering depends on this Stone Model SS-100 LR with the geared-in-head motor that develops full 10 HP. The 22" semi-hi-speed steel friction blade gives up to 1000 cuts per sharpening.

There's a Stone cut-off machine to fit every production line or machine shop requirement. Choose from manual, semi- or fully-automatic chop-stroke or traverse type machines. Steel, friction or abrasive wheels are available to cut ferrous or non-ferrous metals such as bar, pipe, tube, structural, sheet or plate.

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Free-Floating, Easy-To-Use Ziegler Tool Holders permit machine operators to maintain production without scrappage due to alignment inaccuracies, eliminate bell-mouthed and oversize holes and keep job set-up costs to barest minimum.

PROMPT DELIVERY

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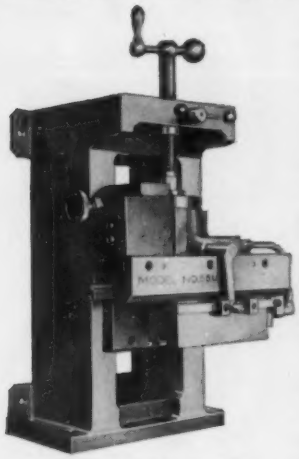
Through simplicity of design, CADILLAC Marking Machines are available in price ranges that meet the demands of cost-conscious buyers.

Shown here are four of the Standard CADILLAC Marking Machines. Highly efficient, they can be installed in your automatic or automated production setup . . . assure permanent product marking. CADILLAC also designs and builds Special Marking Machines, tooling and fixtures, to meet every conceivable marking requirement.



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Also available with our standard base and complete with built-in oil reservoir, oil filter, motor and pump system pressure regulator, foot actuator, and all electrical controls.

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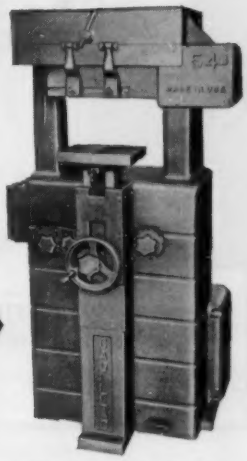
Here single pressure control regulates full range of pressures—marks round, flat and irregular surfaces. Can mark a very light legend into nonferrous metals . . . extremely deep legends into tough steels. It is ruggedly built and simple to operate.



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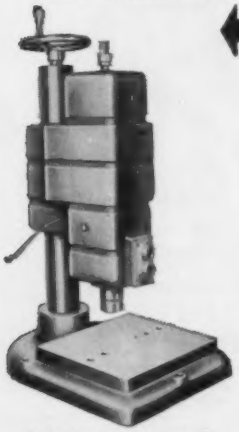

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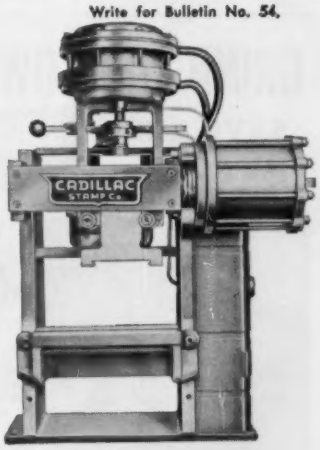
CADILLAC NO. 60-U PNEUMATIC MARKING MACHINE

Meeting the needs for a low-cost, power operated roll marking machine, it offers high speed production, low initial cost, and completely automatic work cycle. Can be easily operated in conjunction with a rotary feed table or in an automated line . . . can be mounted in any position desired. Also available with CADILLAC standard base.



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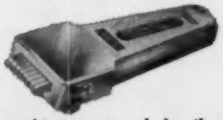
HAND HOLDER
INTERCHANGEABLE
STAMAX TYPE INSERTS



For marking part and detail numbers, dates, inspection marks, tool checks, name plates, etc.

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Automatic Numbering Head
(Special Barrel Style Shown)

Perfect for consecutive serial numbering.
Standard Models Available

SPECIAL STAMAX CODE
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Hard and tough — won't mushroom, chip or split. Priced right.

For further information regarding marking devices and equipment, write for Bulletin No. 41.

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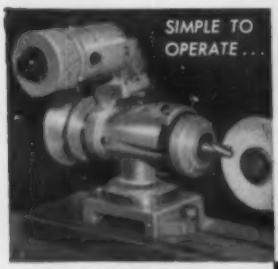

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- CAM-RELIEF GRINDER
- DRILL POINTER

Versatile, dual-purpose grinder for an endless variety of tools. Fits any tool and cutter, or surface grinder. FAST: step a 3/8" drill in 5 min. . . . sharpen tap in 20 sec. . . . grind *HELIXPOINT* in 3 sec.

ENORMOUS RANGE: 1/64" thru 1 1/32"

HARIG AIR-FLO FIXTURE

END-MILL & MILLING CUTTER SHARPENER

Spindle "floats on a cushion of air"! . . . super sensitive, ultra precise, jerk-free, easy to use! *Speeds* and improves sharpening of end-mills and all types of milling cutters . . . small tools 1/32" up to 1 1/4" shank capacity.

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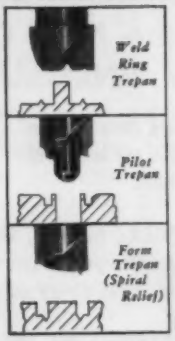
Yankee Ingenuity in Trepan Design



- Cuts tooling costs.
- Doubles number of cutting surfaces.
- Increases tool life on Stainless Steel, Phosphor Bronze, etc.

W&S Trepans are relieved—radially (internal & external) and axially resulting in greater tool life. Available in sizes up to 7/8" diameter with tolerances well within part requirements.

Write today for information on W&S Trepans or any solution to your precision cutting tool problem.

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GET INFORMATION

on Tool and Manufacturing INFORMATION *without writing a letter:*

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on page 127 and 128

WALKER-TURNER 17" DRILL PRESSES

EVERYTHING NEW

but the price!

Because the entire line of W-T "Light-Heavyweight" 17" Drill Presses has been completely redesigned, it now gives you new flexibility, new accuracy and new convenience. You'll like the increased operating economy you get, but even more, you'll like the price tag. All 44 hand feed models of the "New 17" are being introduced at no increase in cost! And for less than $10.00* you can add revolutionary new Rockwell Power Feed and enjoy all the advantages of semi or fully automated drilling operations.

Only *you* can rate the value to your job of pace-setting features such as New Concept Depth Stop, New "Swing Away" Guard and New "Pivoting" Motor Mount. To see this machine in action visit your Walker-Turner Distributor (listed under "TOOLS" or "MACHINE TOOLS" in the Yellow Pages). Learn for yourself why more people in metalworking call Walker-Turner the *value* line.

**Slightly higher in the West.*

FREE BROCHURE pictures and describes the complete line of W-T 17" Drill Presses. Write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WC-25, 400 N. Lexington Ave., Pittsburgh 8, Pa.

WALKER-TURNER
"LIGHT-HEAVYWEIGHT" MACHINE TOOLS
another fine product by
ROCKWELL

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For Stud Setting and Pulling and TORQUE CONTROL TOOLS

"Titantorker" Controlled Torque Driver

For variety of torque uses. Audible signal when desired torque is reached. Easy adjustment. Four sizes: maximum torques from 75" lb. to 225' lb. Female adapters in driving head; male adapters on torque base.

Heavy Duty Jaw Controlled (Torque) Drive Stud Driver

New heavy duty jaw brings the ultimate within reach for users of self-opening stud drivers. Predetermined amount of torque can be applied to stud during driving. For use with any air or electric drill or drill press. Sizes #101 - #102 - #103.

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Built for rugged use on heavy engines. Equipped with Titan Design Loose Pressure Plunger. Definitely stands up under vibration encountered when using an impact wrench for motive power.

Titan "Roll Grip" Combination Stud Driver and Puller

Incorporates roll action to grip as little as ½ in. of unthreaded body of stud. Made in standard sizes from 3/16 to 3 in. inclusive.

TITAN TOOLS — World's Largest Producers Of Stud Drivers And Pullers

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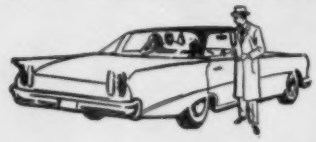

Precision Internal Gage SIZES FROM ⅛" to 10" and larger

COMTORPLUG with interchangeable expanding plugs to gage simple or special holes from ⅛" to 10" diameter.

UNIQUE ADVANTAGES

- Shows exact size, with large graduations easily read within .0001".
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- A fixed — not passing — reading.
- Automatic features assure uniform gaging free of user influence.
- Genuine 2-point gaging, automatically aligned and centered.
- Used at machine . . . on work still in chuck . . . at bench . . . on floor.
- Free from wires, hose, electronic gear.

In the majority of U. S. cars, this unique 2-point gage is at work — also in jet engine, home appliance, electric motor and other volume-precision programs.

Especially valuable AT THE MACHINE because at moderate cost it gives automatic precision within .0001" and enables you to get maximum results from your precision equipment.

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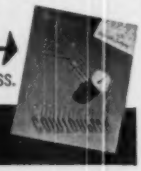
The **Comtor Co.**, 69 Farwell Street, Waltham 54, Mass.



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DOUBLE-CRANK PRESSES

SPEED UP PRODUCTION with these versatile 40-ton presses. Large bed and ram areas make them ideally suited to handle wide rolls or sheets . . . do multiple punching, steel-rule die work and other high output operations. For rapid shockless starting and stopping, presses can be equipped with electrically controlled "Econo-Air" friction clutch . . . Ask for new catalog.

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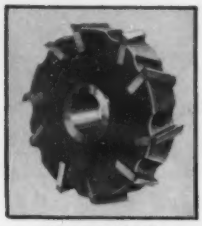
YOUR ONE SOURCE SUPPLIER

Negative rake indexable insert milling cutters

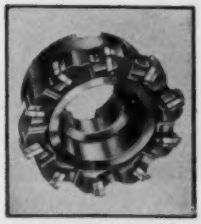


Staggered tooth inserted blade HSS milling cutters

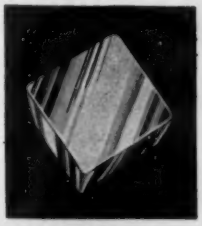
Throwaway-insert boring bars

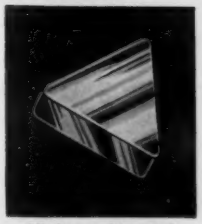
Half side inserted blade milling cutters

Clamp-type throwaway-insert tool holders



Positive rake indexable insert milling cutters





All sizes and types of throwaway-inserts: HSS; cast alloy; carbide; ceramic. Send prints for quotations on Negative and Positive rake inserts.

ONE FOR ALL ... ALL FROM ONE

The wise way to buy Carbide, High Speed Steel, Cast Alloy and Ceramic Throwaway-Inserts, and Tool Holders, Milling Cutters, and Boring Bars is to buy from one knowledgeable source. Viking tool engineers know the applications of not merely one of these items, but of *all* of them as they so vitally relate to each other in order to obtain maximum cutting performance with minimum loss in time and materials. Because Viking engineers are *pioneers in the throwaway-insert and tool industry,* they are uniquely able to recommend the right tool and/or insert for your particular need. They are at your service.

ASK FOR AN INTRODUCTION

Viking TOOL CO.

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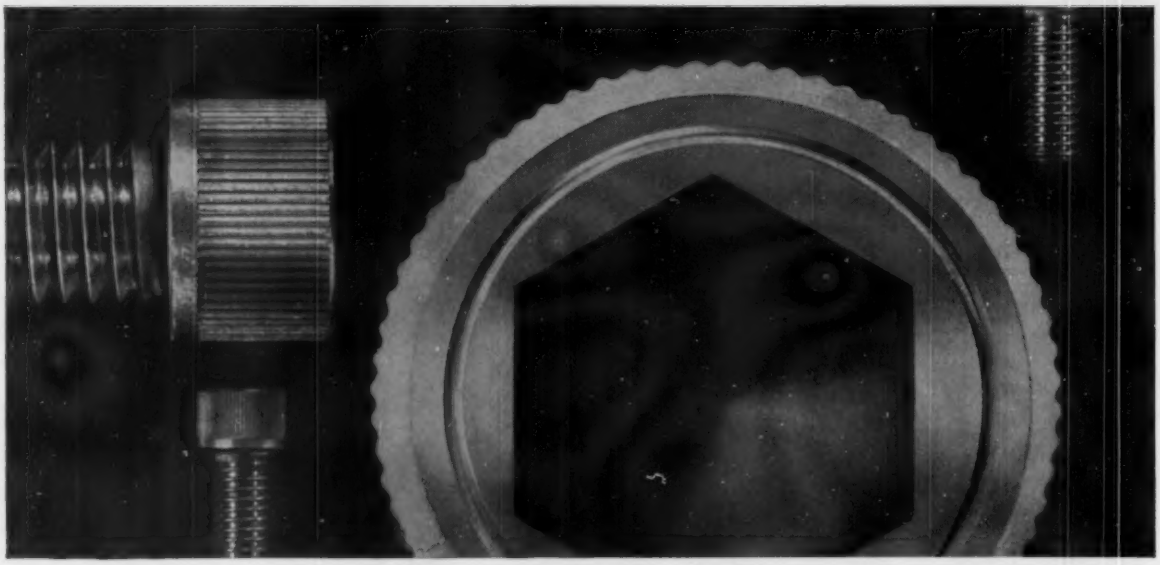

Groove around socket identifies UNBRAKO KS 812 stainless tension fasteners, latest in new SPS high-performance K Series. Affidavit certifying 125,000 psi minimum tensile accompanies every lot.

New UNBRAKO KS 812 stainless socket screws offer 125,000 psi minimum tensile—certified!

TYPICAL MECHANICAL PROPERTIES UNBRAKO KS 812 Stainless Socket Head Cap Screws			
Test Temp.	**−60°F**	**Room**	**800°F**
Ultimate tensile strength, psi	147,000	131,870	101,400
Yield strength, psi	94,000	80,700	70,900
Shear strength, psi		85,000	
Fatigue endurance, psi		40,000	
Stress relaxation Initial stress 65,000 psi Residual stress after 50 hr			55,000
Magnetic permeability		below 1.05	

Besides high tensile strength, KS 812 offers good shear and endurance properties, adding to overall reliability of your stainless assemblies.

Here at last is a stainless steel socket head cap screw offering a guaranteed tensile strength of 125,000 psi *minimum*. Yet this precision-forged, burr-free fastener is a standard, available in quantity off the shelf. With it you can build an extra margin of strength into your stainless assemblies—without using more or larger screws or paying a premium for specials.

To make a corrosion-resistant cap screw that can be certified for 125,000 psi tensile, SPS uses a high-grade austenitic stainless, hardening it through cold working. Heads are forged; threads are rolled to preserve unbroken grain flow and enhance overall mechanical properties. Also the KS 812 has both the UNBRAKO pHd* head, which provides more holding power, and the SPS Hi-Life thread root form, which increases fatigue resistance.

UNBRAKO KS 812 socket screws offer high corrosion resistance over a wide range of applications and are serviceable from −300° to 800°F. Available in sizes #8 to ⅜ in., coarse or fine thread. See your UNBRAKO distributor or write Standard Pressed Steel Co. for new Bulletin 2734. INDUSTRIAL FASTENER Division, SPS, JENKINTOWN 37, PENNSYLVANIA.

*proper Head design (1960 series — standard on all UNBRAKO socket head cap screws, as is Hi-Life thread)

SPS

where reliability replaces probability

Titeflex, Inc., Meets Aircraft Fuel, Lubrication and Hydraulic Line Specifications with

HANDY & HARMAN BRAZE 541

Titeflex operator brazes assembly with torch and hand-fed Handy & Harman Alloy BRAZE 541. *Titeflex is unique in that it makes flexible hose assemblies from raw material to end product—"From End to End, Inside and Out, made RIGHT In Our Own Plant."*

This Springfield, Massachusetts, manufacturer of aircraft and missile fuel, lubrication and hydraulic lines finds that silver alloy brazing with Handy & Harman BRAZE 541 meets rigid operating requirements "all the way down the line."

The tubing and fittings of many of the wide range of assemblies made by Titeflex are 321, 316 and 347 stainless steel and Monel. Brazing is a hand torch, wire and HANDY FLUX operation.

BRAZE 541 is a plastic alloy which melts at 1325° F and flows at 1575° F. Its strength—in shear—at elevated temperatures is 21,500 psi at 500° F and 15,000 psi at 750° F. This alloy's ductility in resisting stress and vibration is very high and its resistance to oxidation and corrosion is equally impressive. The composition of BRAZE 541 is 54% silver, 40% copper, 5% zinc and 1% nickel. It meets AMS Specification 4772.

Aircraft and missile component manufacturers and fabricators are finding—to their and their products' benefit—that Handy & Harman silver alloy brazing is the full and *final* solution to their metal-joining problems. BRAZE 541 is but one of a large family of Handy & Harman alloys, for both low and high temperature applications. We would like to more fully acquaint you with BRAZE 541 and with the advantages that come naturally to silver brazing as a metal-joining (both ferrous and nonferrous) method. Handy & Harman, 82 Fulton Street, New York 38, N. Y.

FOR A GOOD START: BULLETIN 20

This informative booklet gives a good picture of silver brazing and its benefits... includes details on alloys, heating methods, joint design and production techniques. Write for your copy.

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one head is better than more-if it's a

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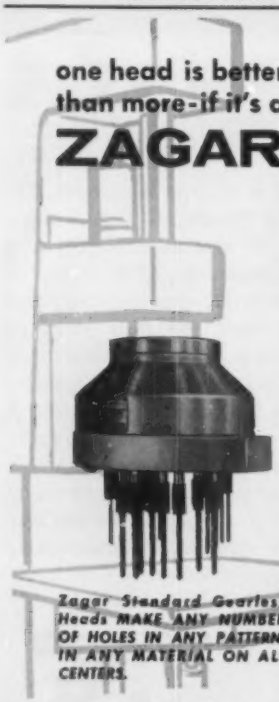

1 to 1000 holes in one pass —as close as twice drill diameter. Costs decrease as spindles are added. And, a variety of hole patterns (or parts) can be produced with one fixed center head. Zagar units are adaptable to standard drill presses or are built as a complete installation. Send in your hole problem to Zagar.

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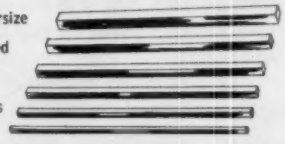

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ARE OBVIOUS.

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THRIFTMASTER
Drillheads
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2. This means they last longer
3. This eliminates down time
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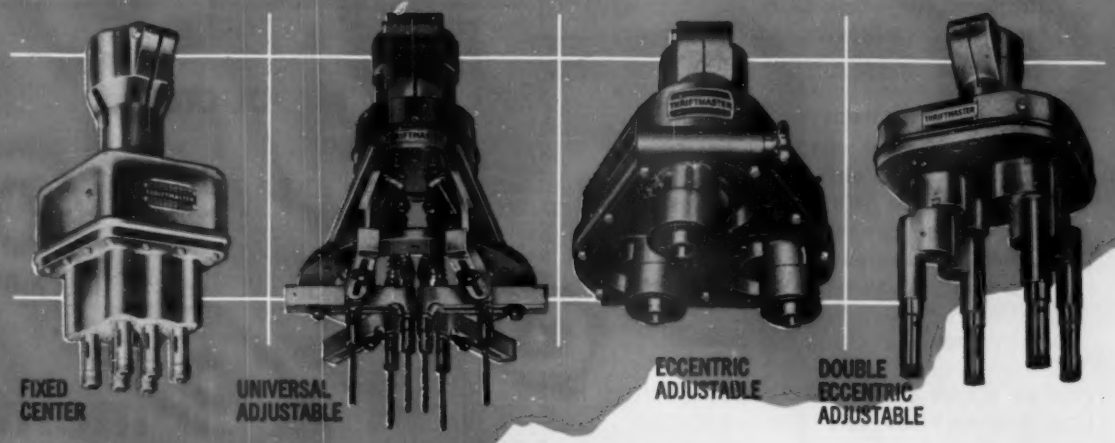

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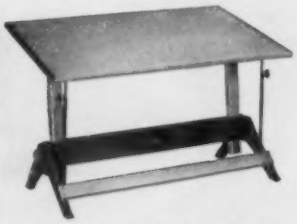

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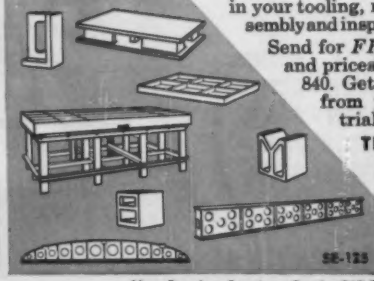

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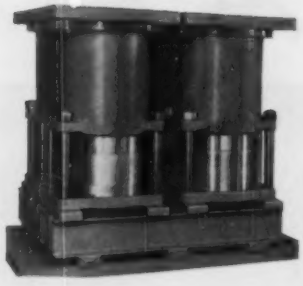

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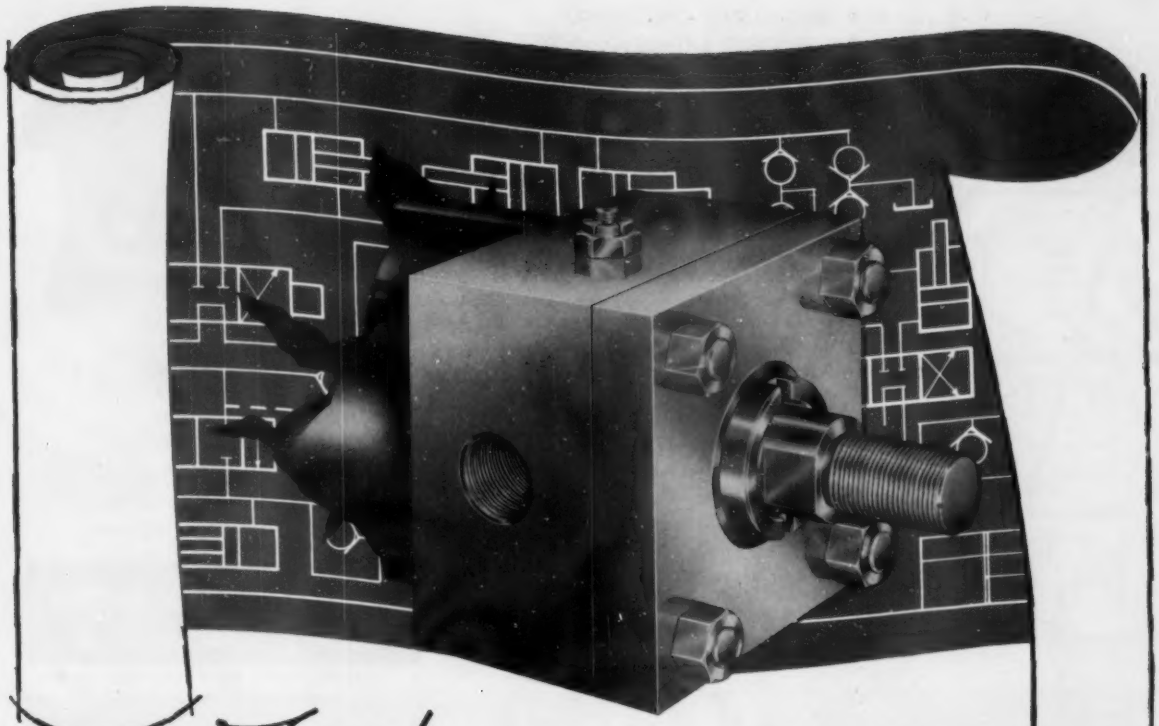

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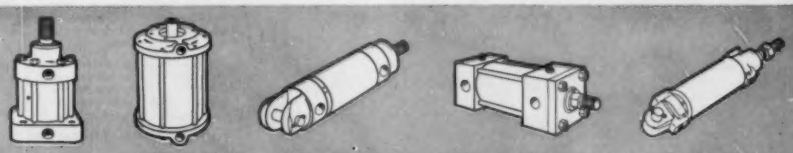

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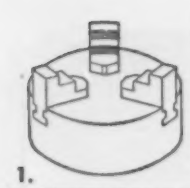
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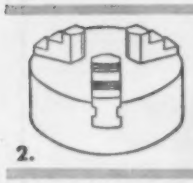
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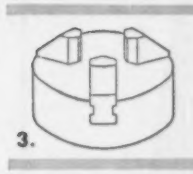
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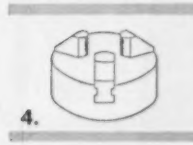
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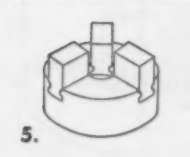
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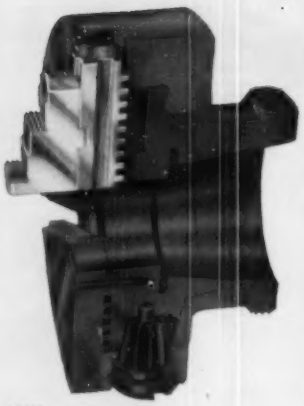
USE UNION BI-METAL HIGH SPEED CHUCKS with PRECISION BUILT JAWS!

Shown at right is cross section of a BI-METAL HIGH SPEED CHUCK recently developed by Union for specialized chucking on high speed lathes. Some lathe manufacturers are already standardizing on Union Bi-Metal High Speed Chucks.

Precision built jaws with all gripping and locating areas ground while jaws are in the finished chuck body assure accurate, sturdy gripping.



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No. 1 Step jaws for outside gripping only.

INSIDE JAWS
No. 2 Step jaws for inside or outside gripping.

OUTSIDE JAWS
No. 3 Smooth bite for outside gripping for pipe or bar cutting.

OUTSIDE JAWS
No. 4 Serrated bite holds work by outside gripping.

SOFT BLANK JAWS
No. 5 Solid Soft Blank for customer forming either inside or outside gripping.

HARD STEPPED TOP JAW
No. 6T Reversible top jaw for outside or inside gripping. Used with 6M Master Jaw.

MASTER JAW
No. 6M For use with 6T Top Jaw or No. 7 Soft Blank Top Jaw.

SOFT BLANK TOP JAW
No. 7 For use with 6M Master Jaw.


6T.


6M.


7.

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UNION MANUFACTURING CO.
CHURCH ST., NEW BRITAIN, CONN.

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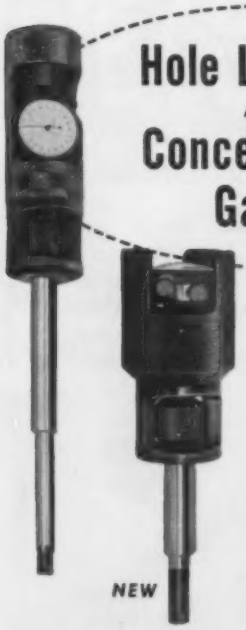

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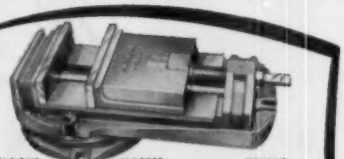

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The first wide range drill press vise that safely handles both rigid and non-rigid work without distortion. Quick action and adjustable pressure at the turn of a knob. Easy hand pressure on hardened and micro-ground bar locks and holds the work.

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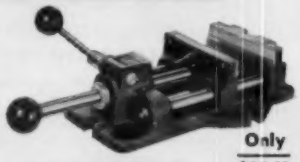

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4" Model	(3½" Opening)	$31.50
6" Model	(6¼" Opening)	$44.00
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Available with or without swivel base.
SEE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR OR ORDER DIRECT, GIVING DISTRIBUTOR'S NAME

Adjusto-Quick JIG-LOK

Simplifies jig and fixture design. Pressure adjustment, 1 to 1500 lbs. Easy hand pressure securely holds work without distortion. One inch of the hardened locking bar is soft for easy machining. 4" x 4" base, $20.00, 5" x 5", $25.00

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The Singer Numerical Control System represents the most direct approach to point-to-point positioning yet conceived. It offers simplicity, reliability and economy, reducing costs of maintenance, labor and downtime.

A major feature of Singer automation is modular design. This makes it possible to assemble basic units in a variety of control systems.

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All that is required is a motor drive assembly (A) and a position indicator control (B) on each axis. This system will then operate with standard end measures.

At any future time, tape control can easily be added to provide a complete Singer Numerical Control System, as shown below with a Fosdick 5BM Sensitive Drill Press.

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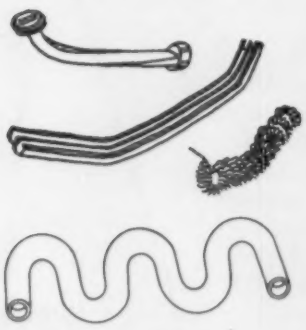
in bending thin-walled tubing

CERROTECHNICS is the practice of using low-temperature-melting CERRO* ALLOYS to expedite many industrial operations.



For bending thin-walled tubing and molding, CERROBEND is an ideal filler. It is poured into an inclined tube immersed in hot water. The loaded tube is then removed and quenched in cold water, after which it is bent over a forming block or in a bending machine. The alloy melts out in boiling water.

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steel
stamps

MARK but don't MAR!

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Gothic style	*size (inches)*
A	1/16
A	3/32
A	1/8
A	5/32
A	3/16
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On all the new lightweight metals HOGGSON BRAND Les-Strain steel stamps are the safest means of permanent identification . . . .

fracture is held to an absolute minimum

rounded faces of the character indent, but do not cut or crack the metal under normal use

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designed with chamfered front edges to assure correct position for marking

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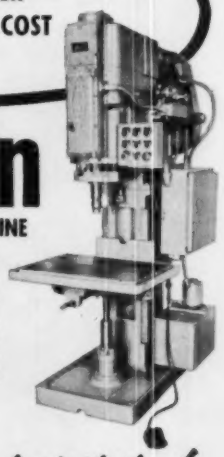

More and more manufacturers are learning this fact from hour after hour, day after day, precision production tapping on the Kaufman 10E-20. With higher production, lower product cost, increased sales in mind — you, too, should learn all about the Kaufman 10E-20.

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PRECISION MACHINES FOR TOP PRODUCTION
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Stops Losses making Dies and Templates

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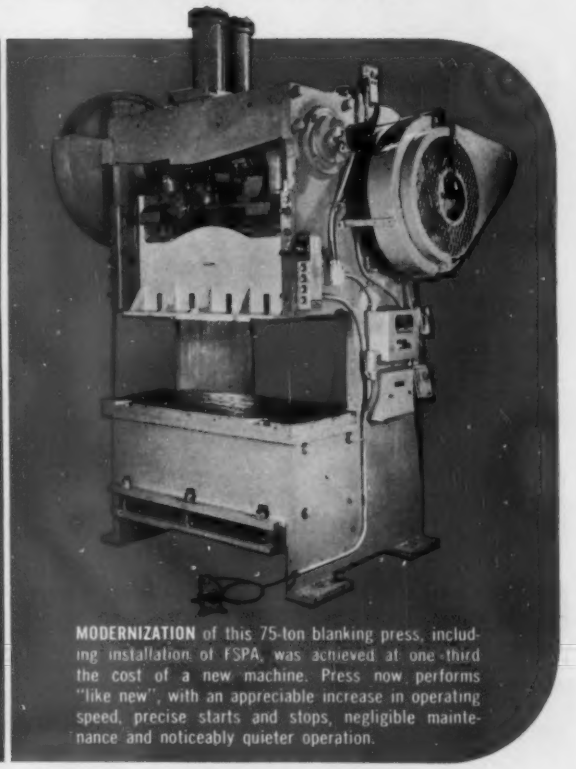
DESIGN or MODERNIZE POWER PRESSES

...with Fawick FSPA

ADVANCED DESIGN of this new press incorporates Fawick Standardized Press Application to insure high-efficiency clutch and brake service needed for machine's 300-stroke-per-minute operating speed. Built by Precision Welder and Flexopress Corp., Cincinnati, the 100-ton press stamps hermetic motor parts 2½ times faster than was previously possible.



MODERNIZATION of this 75-ton blanking press, including installation of FSPA, was achieved at one-third the cost of a new machine. Press now performs "like new", with an appreciable increase in operating speed, precise starts and stops, negligible maintenance and noticeably quieter operation.

... for *high-speed production with precise control*

The FAWICK Standardized Press Application provides the superior air clutch and brake performance needed to gain faster, more precise operation of power presses and other cyclic machines.

For original equipment or for modernization, FSPA helps you fight rising costs. It provides simple, economical installation with wide flexibility of application. Instant air clutch action insures fast, accurate cycling, with unmatched low maintenance and positive safety. Tools and dies are protected through elimination of backlash.

The FSPA package incorporates the dependable FAWICK CB Airflex Clutch, self-energizing CS Brake, Timing Rotorseal and high-speed clutch controls. Standard units are produced for crankshaft mounting on presses in the 5 to 150-ton range. Other conversion units are available for presses up to 2000 tons capacity.

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you can apply FSPA on new or used:

- geared presses
- non-geared presses
- press brakes
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- formers
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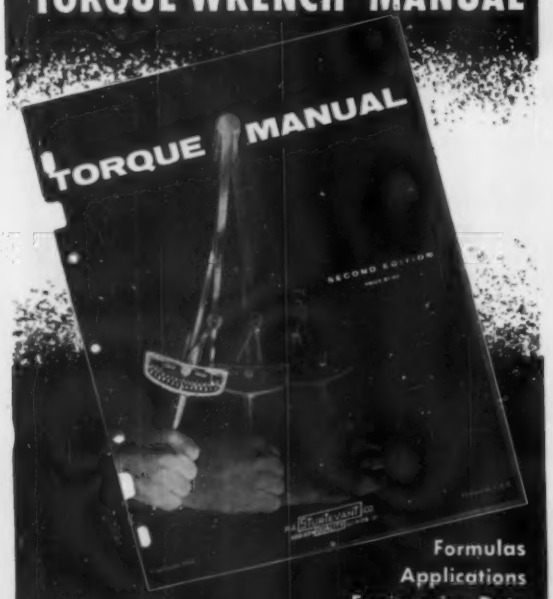

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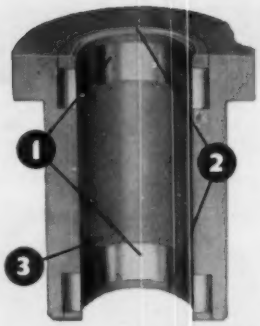

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MODEL 60

Power to Spare—Easy Handling
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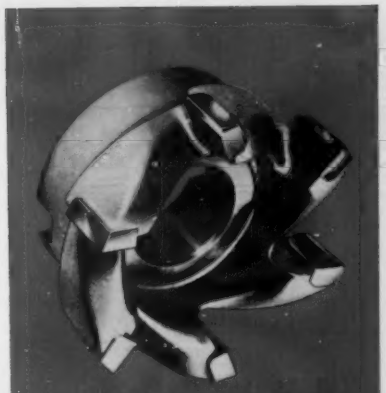
- Special design features make them usable on machine tools where conventional carbide mills cannot be used



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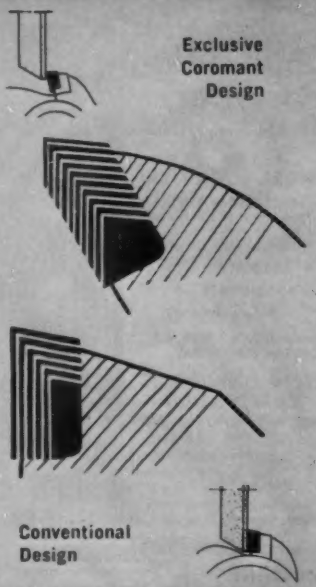

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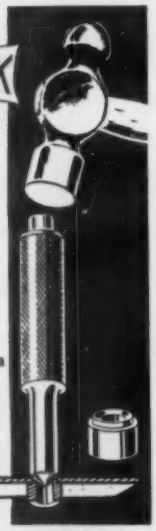

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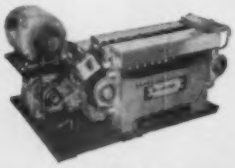

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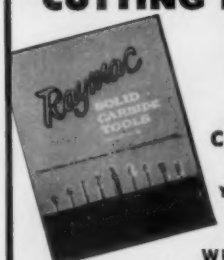

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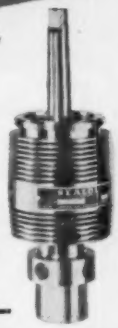

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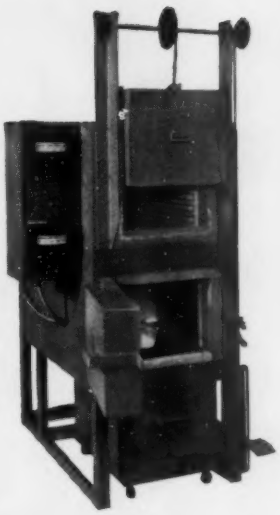


Two series (8012 and 8008) of "space-saver" combination heat treating furnaces are produced by Lucifer Furnaces, Inc. Hardening, drawing or preheating, and quenching operations can be performed with one furnace. Each furnace has separate controls permitting independent operation of each unit. The 8012 series chambers operate at 2300, 2000 and 1250° F.; while the 8008 series chambers reach 2300, 2000, and 800° F. The furnaces operate on standard line voltage . . . no transformer necessary. Twenty standard low-cost models are available and each is a complete unit . . . just connect to power supply.

For information about the "space-savers", our complete line, or free engineering advice, call on . . .

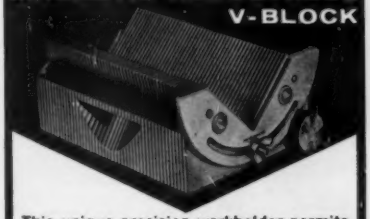
LUCIFER FURNACES, INC.
Neshaminy 25, Pennsylvania
Diamond 3-0411

LUCIFER "SPACE-SAVER" COMBINATION HEAT TREATING FURNACES

Use Reader Service Card, CIRCLE 609

TOOL CRIB SECTION

MAGNETIC ADJUSTABLE V-BLOCK



This unique precision workholder permits quick and accurate setups, saving time, effort and money in grinding operations.

Unsurpassed for layout, toolroom and production. Can be used on any machine equipped with magnetic chucks.

COMPARE THESE DISTINCTIVE FEATURES:

- **Parallelism: ± .00005" over entire length**
- **Maximum setting: 90° angle**
- **Vernier accuracy: ± 15 seconds**
- **Size: 6" long, 4½" wide, 2½" high**

Write today for complete technical data to:

ANTON MACHINE WORKS
1226 Flushing Ave., Bklyn. 37, N. Y.

Use Reader Service Card, CIRCLE 611

EDUCATED FLUSH PINS

FOR TOLERANCES TO ±.00025

Snap them into a Dow-Gage for bench checking . . . or a Tăcomp Stub for in the machine checking . . .

FLUSH PIN BLANKS Only **$15.00**

For Information Write:

DOW

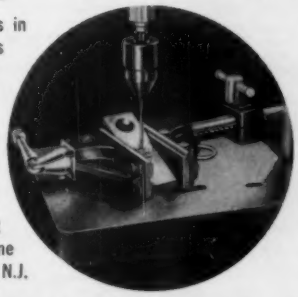
DOW MECHANICAL CORP., THOMPSONVILLE, CONN.

Use Reader Service Card, CIRCLE 608

Instant change cuts production costs

AUTOMATIC KEYLESS CHUCK permits tool changes in seconds without stopping the spindle; prevents chewed-up shanks. One spindle does the work of many. The greater the torque, the tighter the grip.

DRILL PRESS VISE floats, and locks **instantly**, positively, in any position on the table. Holds work safely for accurate drilling and tapping. Three models: 8", 9" and 12" capacities.



Write for illustrated folder and name of nearest distributor to AMF Tool Division, American Machine & Foundry Company, 224 Glenwood Ave., Bloomfield, N.J.

WAHLSTROM® AUTOMATIC CHUCKS (AMF) **FLOAT-LOCK®** SAFETY VISES

Use Reader Service Card, CIRCLE 612

Index of Advertisers

March 1961

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

*Exhibitor in 1960 ASTME Tool Shows

FOSDICK JOB APPLICATION AD RATING

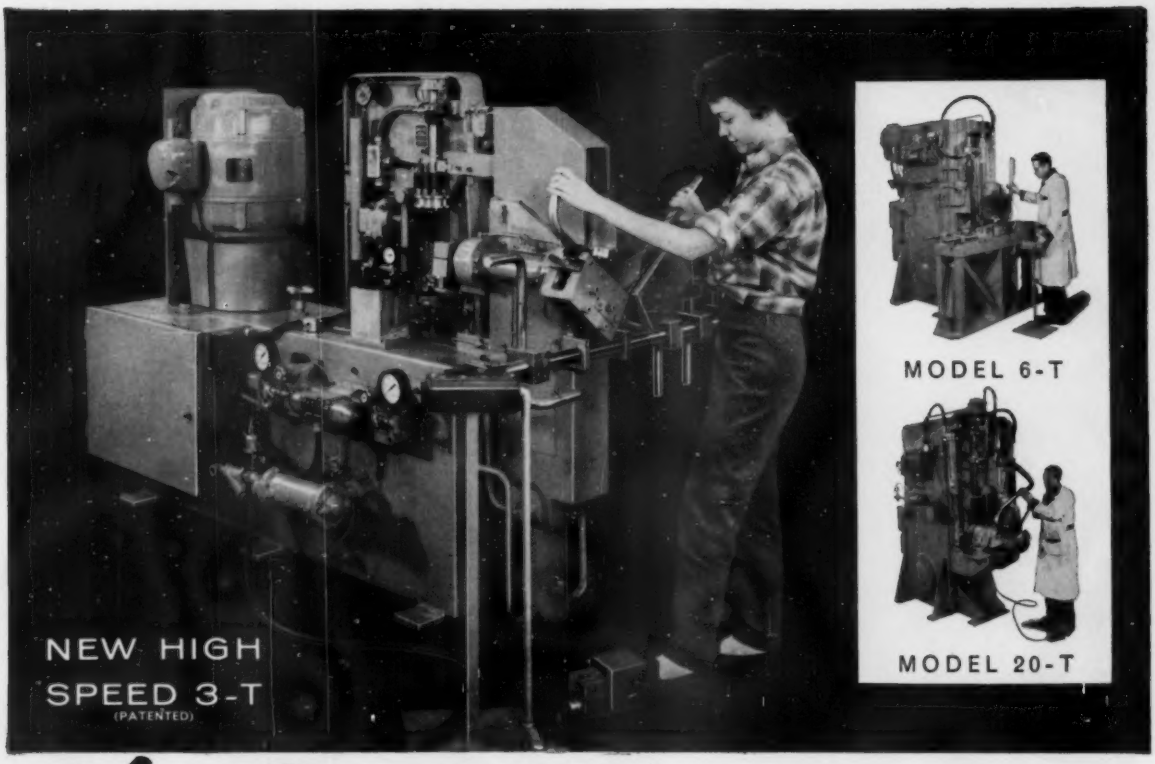
†1960 Directory of Suppliers

Most of the companies listed below have informative listings in the 1960 Suppliers Directory Issue

REGIONAL ADVERTISING OFFICES

Austin G. Cragg, Director of Sales, 500 Fifth Avenue, New York 36, N. Y. Phone: OXford 5-0745

NEW YORK, 36	Francis Baldwin, John Clarke, 500 Fifth Avenue	OXford 5-0745
WEST HARTFORD	Donald N. McElwain, 2636 Albany Avenue	ADams 3-5997
CLEVELAND, 14	George J. Zavis, 1367 E. Sixth Street, Room 200, Lincoln Building	TOwer 1-0330
CHICAGO, 11	Stanley F. Girard, 612 North Michigan Avenue	MIchigan 2-4465
DETROIT, 38	Alan Cobleigh, 10700 Puritan Avenue, W.U.: ZNV Detroit; TWX: DE 974	UNiversity 4-7300
ATLANTA, 3	Gus Krimsier; Cogill, Pirnie & Brown, 1722 Rhodes-Haverty Building	JAckson 2-8113
LOS ANGELES, 4	Dillenbeck-Galavan, Inc., 266 South Alexandria Avenue	DUnkirk 5-3991



More Profitable Bending REPORTED FROM

INCREASED PRODUCTION, BROADER FLEXIBILITY, FASTER SETUP...

. . . **ON NEW PINES HIGH SPEED MODEL 3-T PRESS.** This new progressive bending press has proven the key to increased production, reduced costs on a variety of jobs in such industries as automotive, furniture, appliance, and farm equipment.

"INCREASED PRODUCTION" . . . reported by Bunting Co., Inc., Philadelphia. Accurate, quality bends are produced on the 3-T three times faster than by conventional methods. Speeds up to 1500 bends an hour on tubular parts up to 1" O.D.

"BROADER FLEXIBILITY" . . . says Kalamazoo Furniture Company, Kalamazoo, Michigan. Wide open tooling area permits rapid progressive bending in varied planes. Up to 10 different bend angles are automatically produced in a single setup with maintained plus or minus ½ degree accuracy.

"FASTER SETUP" . . . reported by Configured Tube Products, Bellwood, Illinois. Pick-out pins in indexing turret permit quick bend angle selection, are easily stored with stop gauges for repeat work. Quick change tooling contributes to fast, 15 minute setups.

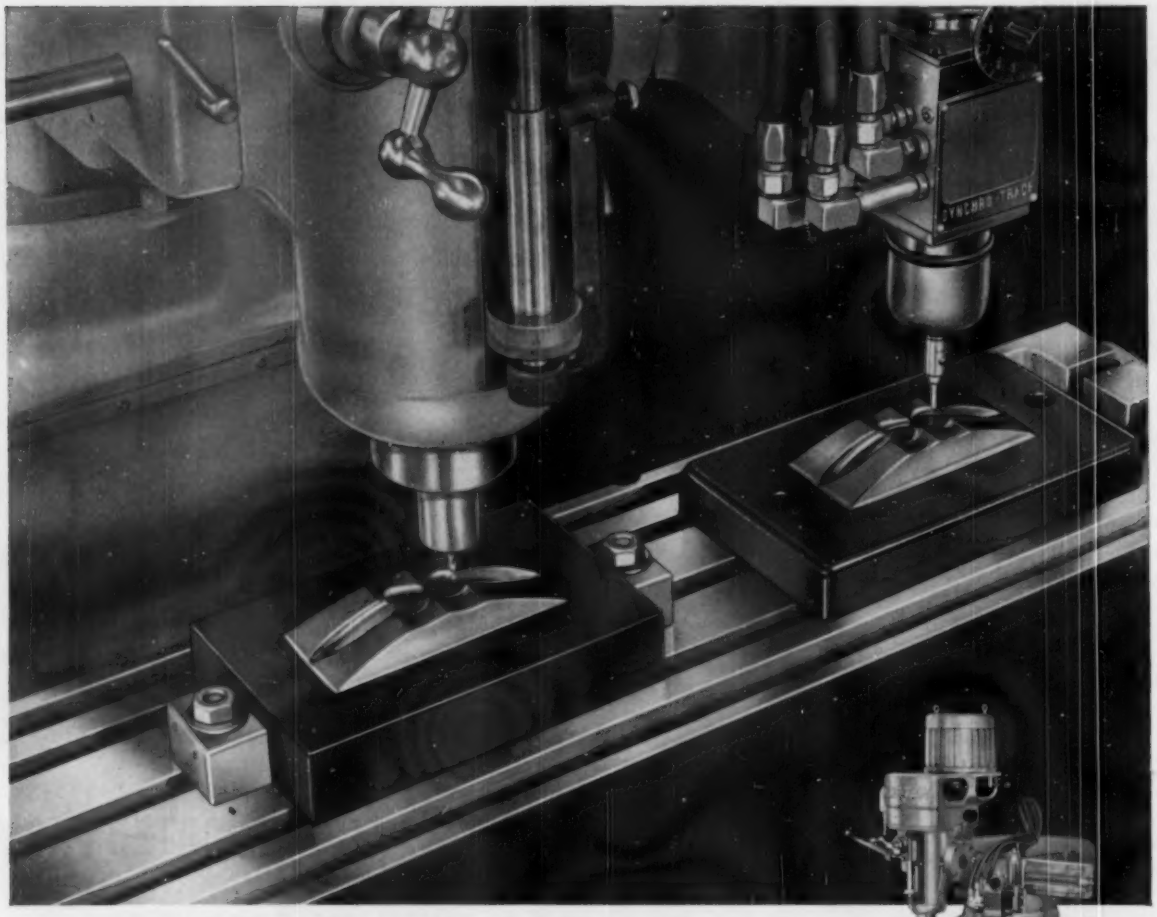
- . . . **ON MODEL 6-T PRESS.** At Chromcraft Corporation, St. Louis, this multiple bending press saves time simultaneously forming "U" frames in two and three tubes per cycle at speeds up to 2000 bends an hour.
- . . . **ON MODEL 20-T PRESS.** At The AP Parts Corporation, Toledo, progressive bending of tubes up to 2" O.D. has increased efficiency 20% with speeds up to 800 bends an hour and near elimination of pass-along work-handling.

Get the complete profit story today. Write for New Catalog 379 on Pines Bending Presses

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery — **695 WALNUT • AURORA, ILLINOIS**

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

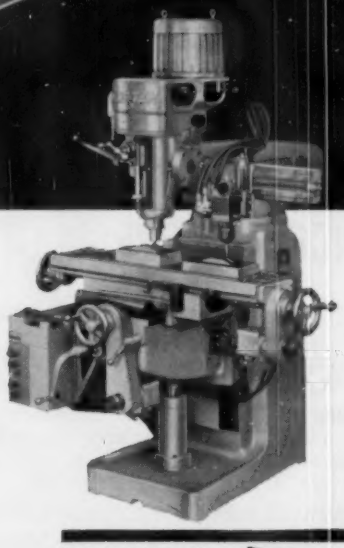


NEW AUTOMATIC DUPLICATOR

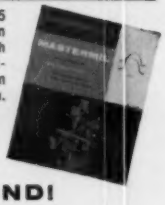
GORTON

Synchro-Trace Mastermil

Now . . . in response to metal-working needs, Gorton presents a fully automatic rise and fall duplicator, ideal for all types of dies and molds in ferrous and non-ferrous materials. Sensitivity and accuracy are combined in this rugged milling machine with versatility for power feed and hand feed milling operations . . . a duplicator to provide you with the simplest, fastest, most accurate way to make dies and molds.



Write for Bulletin 3095 for full particulars on Gorton Mastermil with Integrated Synchro-Trace or Contact Gorton Distrbutor in your area.



A GORTON PRODUCT, THE FINEST OF ITS KIND!

GORTON

SINCE 1893

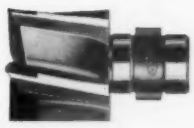
GEORGE GORTON MACHINE CO.

2603 RACINE STREET RACINE, WISCONSIN

Milling, Die Sinking, Profiling and Engraving Machines with Manual Hydraulic, Electro-Hydraulic or Numerical Guidance Systems. Special Machines and Automated Transfer or Indexing Machines. Cutting Tools and accessories...Defense and special products.

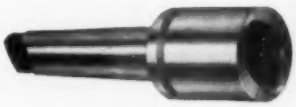
6 Features that make a big difference in counterboring operations!

1. HAND DETACHABLE . . . a twist of the wrist engages or releases the cutter after the severest cutting operation.

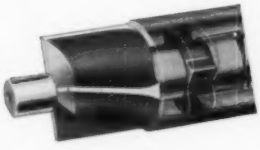


4. BALANCED DRIVE . . . double bearings—one on each side of drive lug—provide extra rigidity.

2. STURDY DRIVE . . . diametrically opposed drive lugs engage corresponding abutments in the holder.

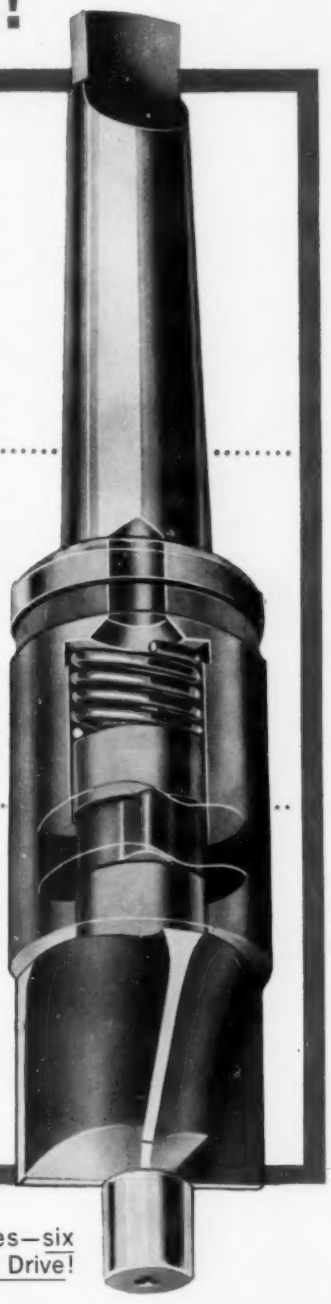


5. FREE FROM OBSTRUCTIONS . . . holder body slips easily into a bushing or can be threaded for stop nuts or collars or fluted for lubrication.



3. EXTRA TORSIONAL RIGIDITY . . . drive lugs are close to seating shoulder of cutter for powerful, smooth operation.

6. PRACTICALLY INDESTRUCTIBLE . . . no binding, no shearing—driving forces apply compression.



These are the features that make the difference in counterbores—six reasons why no one reports failure of a Continental Counterbore Drive!

Continental (CTW) TOOL WORKS
DIVISION OF EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
60-45

Use Reader Service Card, CIRCLE 103

AT O'KEEFE & MERRITT...

everyone's impressed by the quality of Stampings

produced by this Verson 300 ton Eccentric Press

As part of a long range expansion and modernization program, O'Keefe and Merritt Co., Los Angeles appliance manufacturers, have installed this 300 ton Verson Eccentric Press.

Before buying they stated their requirements as follows: The press must improve quality, eliminate excessive handling, provide uniform parts and reduce rejects, and be adaptable to fabricating a wide variety of pieces. That's a big order . . . the Verson Eccentric fills it.

Shown above are officials of the company checking the first burner box bottom for a free standing range formed in the new press. They liked what they saw . . . the press performs two operations, requires one operator, and produces a high quality stamping.

Do you have tough press requirements? You'll find that Verson can meet them. It's easy to put the Verson team to work for you. Just contact your Verson Representative.

250

VERSON ALLSTEEL PRESS CO. / 9336 S. Kenwood Avenue, Chicago 19, Illinois
8300 S. Central Expressway, Dallas, Texas

MANUFACTURERS OF MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES
TRANSMAT PRESSES • IMPACT MACHINING PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES • HYDRAULIC SHEARS

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